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July 1981

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Atlas of Coal/Minerals and Important Resource Problem Areas for Fish and Wildlife in the Conterminous United States

Oak Ridge National Laboratory

Fish and Wildlife Service

U.S. Department of the Interior

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The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems.

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FWS/OBS-81/06
July 1981

ATLAS OF COAL/MINERALS AND IMPORTANT RESOURCE PROBLEM AREAS FOR FISH AND WILDLIFE IN THE CONTERMINOUS UNITED STATES

by

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PREFACE

The need for an appropriate balance between coal and minerals development activities and fish and wildlife resources has never been greater. Americans are aware of the urgent need for greater productivity from existing mines and the need to rapidly develop new mines. On the other hand it is our intent to protect the current stock of biological resources and where possible to create new habitat for fish and wildlife through sound planning for mine land reclamation. However, for many administrators and scientists, little consolidated information specifically related to fish and wildlife concerns is available for use in national and regional planning for development of mineral extraction facilities.

Beginning in early 1980, the Eastern Energy and Land Use Team, Office of Biological Services, U.S. Fish and Wildlife Service, in cooperation with Oak Ridge National Laboratory (Department of Energy), initiated development of this atlas depicting the Fish and Wildlife Service's Important Resource Problem Areas (IRPs) and 12 important mineral commodities. The information, presented on 20 semi-transparent maps and in this accompanying descriptive text, should be especially useful to administrators at national and regional planning levels. The Atlas will facilitate recognition of desired balanced objectives for fish and wildlife and mineral resources.

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SUMMARY

This atlas highlights areas in the conterminous United States of potential concern involving coal and minerals development activities and fish and wildlife resources, in particular the Important Resource Problem Areas (IRPs) designated in 1980 by the U.S. Fish and Wildlife Service (FWS) as areas of emphasis in policy making. National and regional administrators and planners have need of such information due to several national, state, and local laws which currently require landowners to minimize disturbances and adverse impacts on fish and wildlife resources and protect and enhance these resources where practicable. This atlas serves as an initial screening tool for planners and administrators to help define areas that may require further analysis prior to development.

The atlas consists of two parts. The first part is a series of twenty 1:7,500,000-scale county-level resolution maps of the conterminous United States that depict deposits of selected mineral resources (coal, copper, geothermal resources, gold, iron, molybdenum, nickel, oil shale/tar sands, peat, phosphate, silver, and uranium), FWS IRPs, Federal Endangered and Threatened Animal Species, and county names. By overlaying a wildlife map onto a mineral map, counties containing both mineral and wildlife resources will be highlighted, thus serving as an initial screening tool to help define areas of concern. The maps can also be used with a variety of other 1:7,500,000-scale maps, such as those in The National Atlas of the United States of America (USGS 1970). The second part of the atlas is a text that serves to orient the reader as to the use of the 20 maps and contains background information on IRPs, the mineral commodities, and environmental impacts of mineral mining activities, as well as appendices that tabulate the information found in the 20 maps.

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ABBREVIATIONS

FWS	U.S. Fish and Wildlife Service (Department of the Interior)
IRP	Important Resource Problem
NAS	National Academy of Sciences
USBOM	U.S. Bureau of Mines (Department of the Interior)
USDOC	U.S. Department of Commerce
USDOE	U.S. Department of Energy
USFS	U.S. Forest Service (Department of Agriculture)
USGS	U.S. Geological Survey (Department of the Interior)
USWRC	U.S. Water Resources Council

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Robert A. Honig performed work on this atlas in part while serving on a Cooperative Ecological Internship with the Institute of Ecology, Butler University, Indianapolis, Indiana 46208.

INTRODUCTION

Approximately 1.5 million hectares (3.7 million acres) of land in the United States have been disturbed by surface mining between 1930 and 1971 (Paone et al. 1974). This extensive area indicates that potentially serious problems exist for fish and wildlife populations on these lands. In addition, underground mining causes untold impacts to off-site lands and ground water resources. Whether the disturbance is localized or widespread, the total effect is to reduce the amount of available habitat for fish and wildlife and often to render the land and water unfit for healthy, productive fish and wildlife populations. Thus, administrators and regional planners have a need for information that documents areas of possible concern due to coincidence of minerals development activities and fish and wildlife resources. With impending new exploration and mining to supplement future strategic and critical mineral resource needs (Terrell 1980), broad scale planning tools, such as this atlas, will be of increasing use for years to come.

This atlas of fish and wildlife Important Resource Problem areas (IRPs) and 12 selected mineral commodities provides national and regional administrators and scientists with a ready reference document for land use planning purposes. The U.S. Fish and Wildlife Service (FWS) recognized 78 IRPs (Appendix A) as of June 1980. These IRPs, each assigned a given rank from 1 to 78, are described in the U.S. Fish and Wildlife Service IRP Source Document (FWS 1980b) and are depicted in a generalized map of the United States (including Alaska, Hawaii, Puerto Rico, and the Virgin Islands)(FWS 1980a). To date however, no published information on IRPs includes the particular counties involved (highly important to national and regional planners), and available maps are not drawn in a commonly used scale (e.g. 1:7,500,000). Also, various categories of fish and wildlife (fish, amphibians, reptiles, birds, mammals, and invertebrates) and threatened and endangered species are not mapped. Therefore, it is difficult to define possible areas of concern where mineral commodity developments may impact fish and wildlife habitat.

To depict counties of interest, data for the mineral resources, IRPs, and threatened and endangered species in the 48 conterminous United States were compiled into the Geoecology Data Base (Olson et al. 1980) at Oak Ridge National Laboratory, Oak Ridge, Tennessee (the Geoecology Data Base does not include Alaska, Hawaii, and U.S. territories; thus the scope of this atlas is limited to the conterminous United States). The use of this data base in conjunction with a computer mapping program (Coleman 1978) resulted in the generation of county level maps. Maps of the IRPs and the mineral commodities provide the national and regional planner with an easy to use representation of the data that can be overlaid in any desired fashion to assist in identifying areas of concern. This will help achieve the desired balance between fish and wildlife habitat preservation and needed mineral development projects.

The need for the kind of data presented in this atlas resulted from several national, state, and local laws dealing with fish and wildlife protection and enhancement in relation to surface mining. The "Surface Mining Control and Reclamation Act of 1977" (SMCRA), Public Law 95-87, and its supporting Regulations (March 1979) emphasize the need to minimize surface mining impacts to fish and wildlife populations and to return the reclaimed habitat to productive uses, including fish and wildlife habitat among the alternatives. Enhancement of fish and wildlife habitat and protection of the biota before and during mining and consideration of post-mining reclamation also are addressed in the Act. Several sections of the Regulations of SMCRA that concern fish and wildlife were remanded by Federal District Court, and thus reference to these sections is inappropriate at this time. However, it is well documented that the mining industry and states have supported enhancement of fish and wildlife on mined lands where possible; and there are already many surface mining programs which benefit fish and wildlife.

In addition to SMCRA, there are other noteworthy federal and state laws relating to surface mining of minerals. For example, pursuant to the Mineral Leasing Act of 1920, the U.S. Forest Service is responsible for leasing and land management of National Forest lands (Plantico, in prep.); and -- within the U.S. Department of the Interior -- the National Park Service, the Bureau of Land Management, and the Geological Survey participate in lease management, pursuant to the same law. The Bureau of Land Management administers public mineral resources through several laws. The U.S. Army Corps of Engineers and U.S. Environmental Protection Agency administer dredge and fill and water quality and quantity permits relating to surface mining. State programs have been established to enforce and monitor surface mining discharges. The U.S. Fish and Wildlife Service, in addition to advising the above agencies, manages land incorporated into the National Wildlife Refuge System. Unlike the western United States, where much of the land used for mineral development is administered by federal agencies, most mining in the eastern United States is on private lands under the regulation of state and local laws. Detailed discussion of federal and state laws involving fish and wildlife resources are contained in several documents (e.g. Plantico, in prep.) and numerous documents available from the various agencies.

ATLAS MAPS

The atlas consists of two parts: a series of twenty 1:7,500,000-scale maps; and this text which serves to orient the user to the 20 maps. The twenty 1:7,500,000-scale maps (Table 1) portray, on a county level of resolution, distributions of selected mineral resources (Maps 1-12) and fish and wildlife resources (Important Resource Problems, Maps 13-18; and Federal Endangered and Threatened Animal Species, Map 19), with Map 20 identifying county names. Areas of overlap between a wildlife resource and a mineral resource will be highlighted by overlaying a wildlife map onto a mineral map, or vice versa (or by overlaying the Important Resource Problem Area transparency, supplied inside the back cover of this document, onto Figures 4-15). Thus the maps serve as an intitial screening tool for planners and administrators to help define areas that may require further analysis prior to development.

Table 1. Titles of 1:7,500,000-scale national maps.

No.	Title
1*	Coal Reserves
2*	Copper Deposits
3*	Geothermal Resources
4*	Gold Deposits
5*	Iron Deposits
6*	Molybdenum Deposits
7*	Nickel Deposits
8*	Oil Shale and Tar Sands Deposits
9*	Peatlands
10*	Phosphate Deposits
11*	Silver Deposits
12*	Uranium Deposits
13*	FWS Important Resource Problem Areas
14	FWS Important Resource Problem Areas, Birds
15	FWS Important Resource Problem Areas, Fish
16	FWS Important Resource Problem Areas, Invertebrates
17	FWS Important Resource Problem Areas, Amphibians and Reptiles
18	FWS Important Resource Problem Areas, Mammals
19*	Federal Endangered and Threatened Animal Species
20	County Names

* Maps also contained in this text.

Counties were chosen as well-defined geopolitical units and are particularly relevant because many planning and permitting processes occur at that level of government. Counties also serve as spatial units for many data files and can be easily mapped with computer programs. Unfortunately the large size of some counties, especially in the west, can give a distorted visual impression of some parameters. Most of the maps indicate simply the presence or absence of an attribute within counties. Therefore, even if the occurrence of an attribute is restricted to a small portion of a county, the map may give the impression of a much larger occurrence. However, many of the attributes, such as species' ranges or peat deposits, are not well defined. Thus a county-level distribution may very well represent a good approximation of these distributions. Nevertheless, as a result of these factors, care should be taken in making specific interpretations from the maps.

There are 3,071 county units in the conterminous United States as defined in this study. Map 20 identifies county names for the conterminous United States. Appendix C contains these county names in addition to Federal Information Processing Standards (FIPS) codes (USDOC 1973). These codes are generally odd numbers assigned sequentially to counties arranged alphabetically within a state. Also in Appendix C are listed the IRP's and minerals occurring within each county. Yellowstone National Park was excluded from the maps since it is a separate county unit exempt from minerals exploitation. The maps were generated with the EZMAP program (Coleman 1978) developed by the Geographic Systems Group for use at Oak Ridge National Laboratory. The IRP and minerals data files were added to the Oak Ridge National Laboratory Geoecology Data Base (Olson et al. 1980) which contains extensive county-level data for environmental attributes in the conterminous United States. These paramenters include endangered and threatened species, bird and mammal distributions, vegetation, forestry, agriculture, terrain, climate, and land use. Therefore, additional environmental parameters can be easily integrated into future studies to investigate habitat characteristics of each IRP and potential effects of minerals exploitation.

The use of 1:7,500,000 scale maps permits comparison with numerous other maps that are available at that scale. Examples of such maps are: Water Resources Aggregated Subregions (USWRC 1977); Ecoregions of the United States (Bailey 1976); Ecosystems of the United States (USFS 1978); and many maps in The National Atlas of the United States of America (USGS 1970), including maps concerned with landforms, soils, vegetation, surface and ground water, forest types, land use, minerals, population, federal lands, and many other subjects.

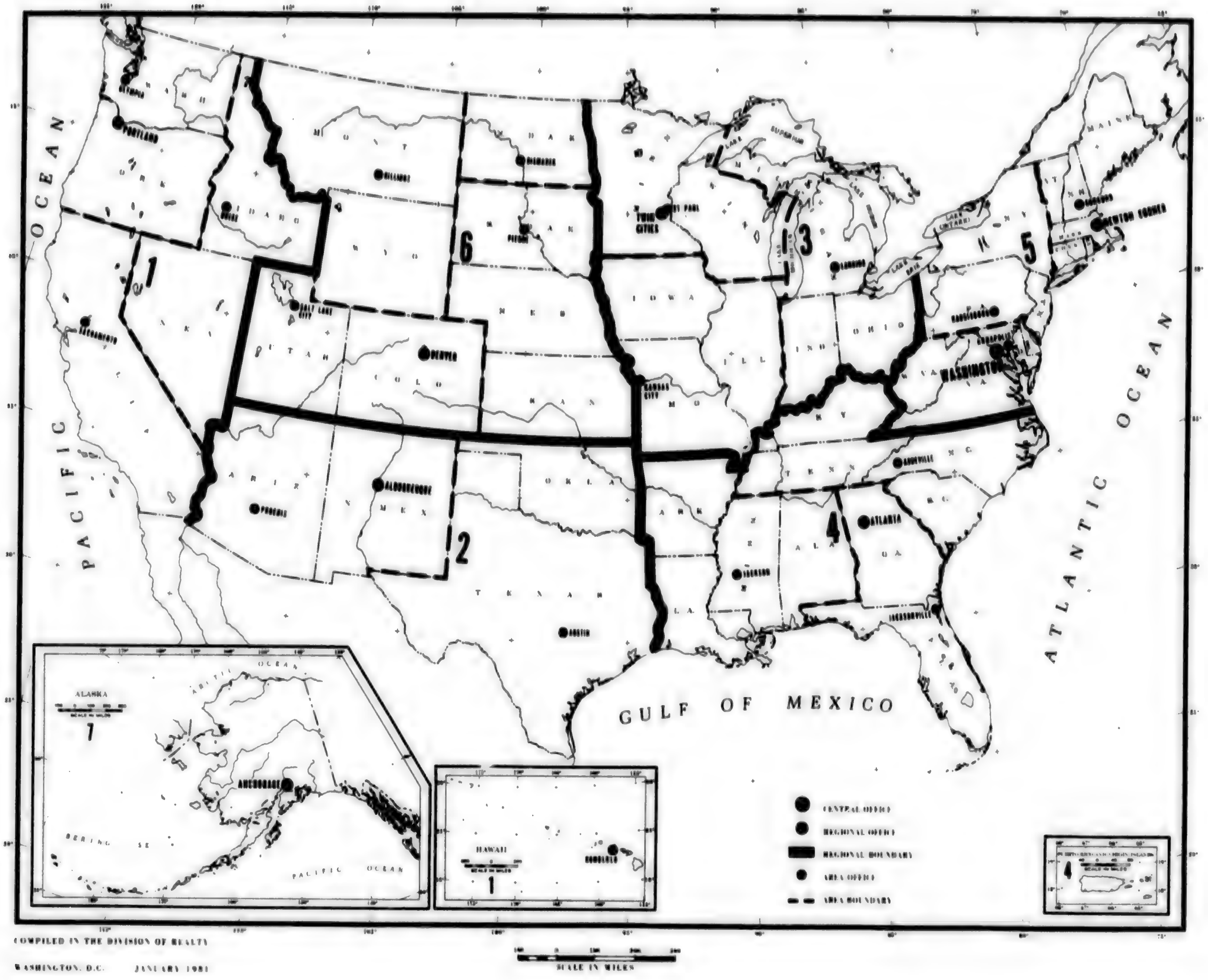

Figure 1. U.S. Fish and Wildlife Service Regions.

IMPORTANT RESOURCE PROBLEMS (IRPs)

In September 1979, the U.S. Fish and Wildlife Service (FWS) of the Department of the Interior developed the concept of National Important Resource Problems (IRPs). IRPs are simply defined as those fish and wildlife resources having significant problems in specific geographic areas. Each IRP indicates that a certain species or community of species in a given area is or will be under significant stress. This represented a coordinated attempt to identify program priorities so that FWS efforts can be focused on areas of critical need. The IRP concept is not by any means intended to be an exclusive statement of FWS Habitat Preservation activities, but rather to define areas of emphasis for FWS activities (FWS 1980a, 1980b).

On the basis of a series of ranking factors, FWS assigned priorities to 70 IRPs nationwide. This list was revised in June 1980 to a total of 78 IRPs (Appendix A). The nationally ranked list was formulated from a larger group of IRP proposals determined by the seven FWS Regions (Figure 1) and FWS Research Division. Most IRPs involve aspects of habitat such as physical destruction, chemical contamination, and/or reduction in water quantity and/or quality (FWS 1980a). The key ranking factors included (FWS 1980b):

- Current status of population;
- Current status of habitat (of target species);
- FWS responsibilities for protection, management, or restoration of the resource;
- Resource value to humans (e.g., recreational or commercial benefits);
- Magnitude of potential loss;
- Immediacy of threat;
- Desired objective for IRP (i.e., desired quantity or quality of species population or human use levels).

Thus, the priority ranking of the IRPs reflects their perceived importance in terms of the fish and wildlife resources for which FWS has a responsibility (FWS 1980b). Continuing reviews and updates will improve the validity and precision of the work.

Of the 78 IRPs, 63 are located within the 48 conterminous United States. Four of these -- acid rain, lead poisoning in migratory birds due to use of lead shot by hunters, migratory bird diseases (avian cholera and duck virus enteritis or DVE), and impacts of exotic fish on native endangered fish species -- are national in scope and not relevant to problems resulting from mining activities. Thus, 59 IRPs are within the scope of this atlas.

Maps 13-18 (Figure 2). Geographical distributions of the IRPs at county-level resolution were determined from FWS maps (FWS 1980b) by noting all counties that are totally or partially occupied by an IRP. For IRPs that are primarily concerned with rivers, counties on both river banks are included; adjacent shoreline counties are included for open water IRPs (e.g., Great Lakes, oceans, Gulf of Mexico). Concurrence with these distributions was provided by FWS Regional Offices and FWS Research Division.

Map 13 (and Figure 2) is a composite county-level map of IRPs in the 48 conterminous United States; a transparency of Figure 2 is provided for use as an overlay with the other maps (Figures 1, 3-15) in this text. Maps 14-18 are concerned with single major groups of animal species associated with the IRPs (see Table 1) and are not reproduced in this text. IRPs are listed by associated animal type in Appendix B. Appendix C lists all counties in the conterminous United States along with associated IRPs and minerals.

It should be noted that the FWS Headquarters, Washington, D.C., has issued a set of 8½" X 11" IRP maps, which were prepared for general national and regional planning. These 8½" x 11" maps are not as accurate as the IRP maps contained in this atlas, which have been reviewed by the FWS Regional Offices and contain more detail.

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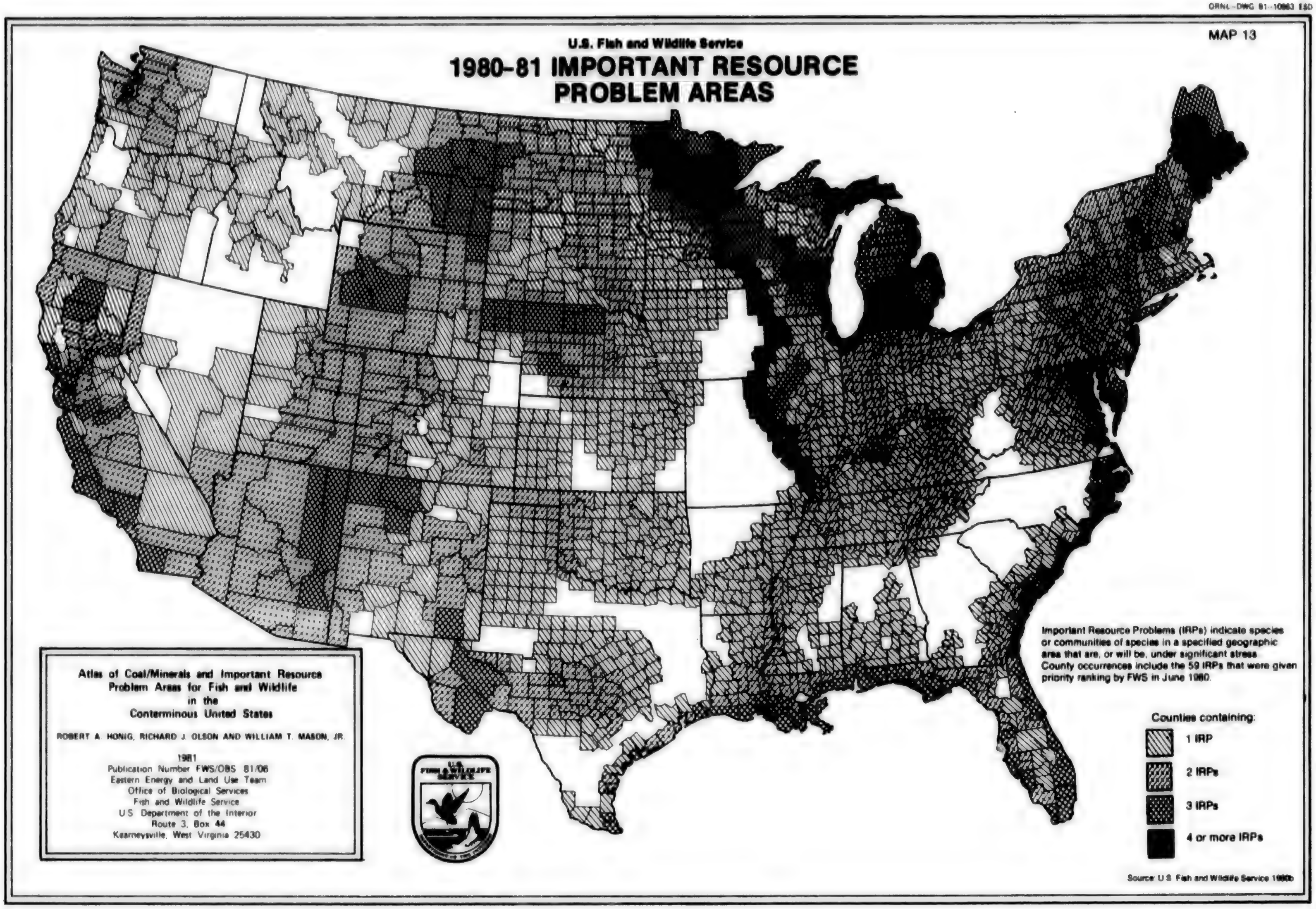

MAP 13

U.S. Fish and Wildlife Service

1980-81 IMPORTANT RESOURCE PROBLEM AREAS

Important Resource Problems (IRPs) indicate species or communities of species in a specified geographic area that are, or will be, under significant stress. County occurrences include the 59 IRPs that were given priority ranking by FWS in June 1980.

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U.S. Department of the Interior
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Source: U.S. Fish and Wildlife Service 1980b

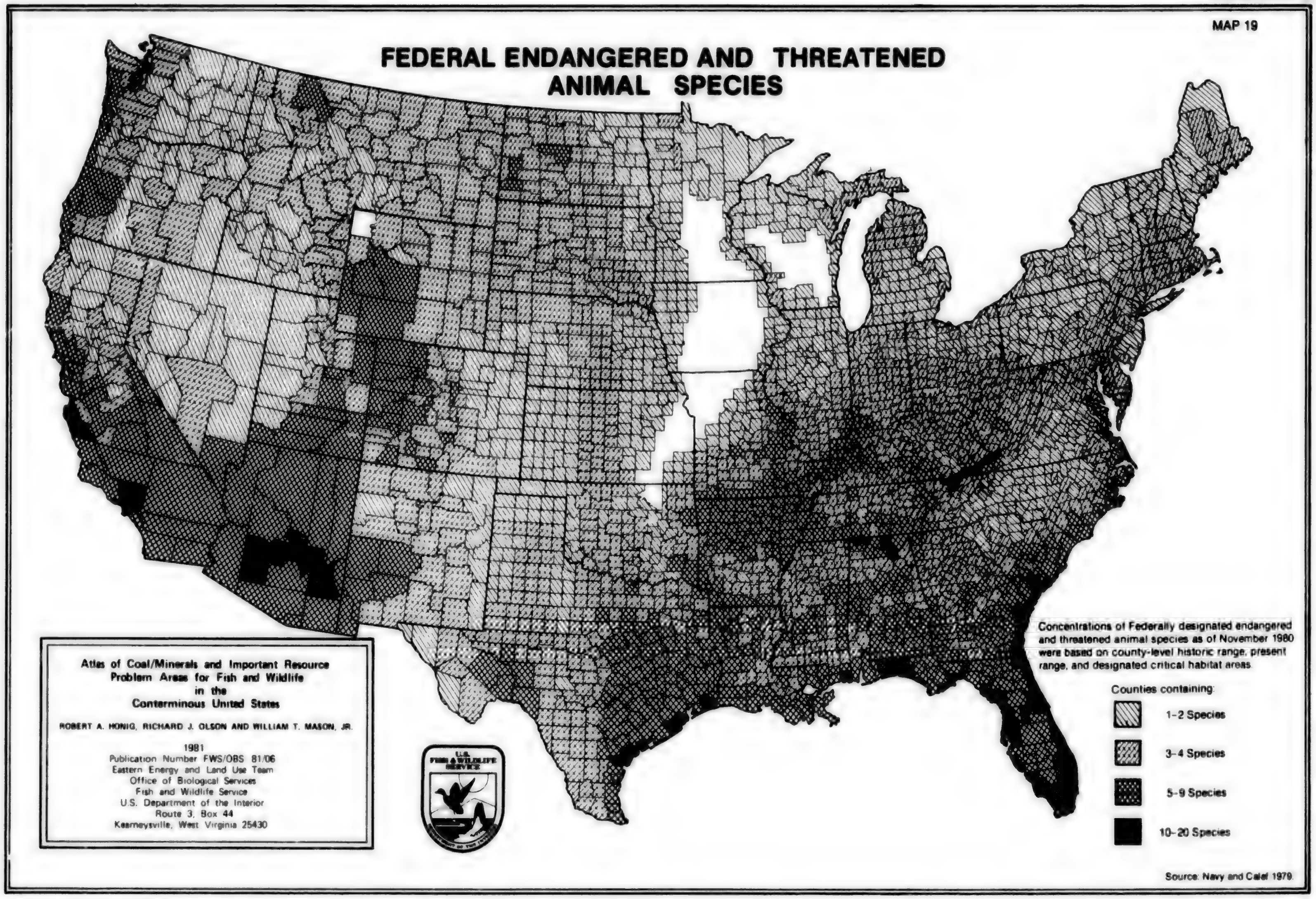
Figure 2. County-level distribution of U. S. Fish and Wildlife Service Priority IRPs (determined June 1980) in the conterminous United States. Nationwide IRPs are not illustrated (see text). A transparent reproduction of this map is included inside the back cover of this document. It can be used to overlay each mineral commodity map (Figures 4-15) to highlight areas of potential concern due to coincidence of IRP and mineral distributions.

ENDANGERED AND THREATENED ANIMAL SPECIES

The present listing of endangered and threatened species is a result of the Endangered Species Act of 1973, Public Law 93-205. This act provides for the conservation of endangered (in danger of extinction) and threatened (those not presently in danger of extinction but likely to become so) species of fish, wildlife, and plants by federal action and by encouraging the development of state programs. The Act authorizes determination and listing of endangered and threatened species (including foreign species) and the portion of their ranges where such status exists; prohibits unauthorized taking, possession, sale, transport, importing, etc., of endangered species; authorizes acquisition of land for the conservation of listed species with land and water conservation funds; and authorizes the assessment of civil and criminal penalties for violating the Act or regulations (FWS 1979; Clark 1979). In addition, Section 7 of the Endangered Species Act requires that any federal action not jeopardize the existence of listed species nor modify their critical habitat. In November 1978, Public Law 95-632 made extensive revisions to the 1973 Act. Among these revisions was establishment of a process whereby federal agencies may obtain an exemption from the requirements of Section 7 (FWS 1979). The most recent listing of federal endangered and threatened animal species was published on May 20, 1980 (FWS 1980c).

Map 19 (Figure 3). Federal endangered and threatened animal species distribution data for the conterminous United States were compiled from the United States Endangered Species Distribution file (Nagy and Calef 1979). The distribution depicted on Map 19 reflects the May 20, 1980, listing of federal endangered and threatened animal species (FWS 1980c).

ORNL-DWG 81-10857 ESD



MAP 19

FEDERAL ENDANGERED AND THREATENED ANIMAL SPECIES

Concentrations of Federally designated endangered and threatened animal species as of November 1980 were based on county-level historic range, present range, and designated critical habitat areas.

Source: Navy and Calef 1979.

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Figure 3. Concentrations of federal endangered and threatened animal species.

MINERAL RESOURCES AND ENVIRONMENTAL IMPACTS OF MINING ACTIVITIES

Sixteen mineral commodities were chosen for inclusion in the atlas. These commodities were chosen because: (1) they were emphasized, because of their long-range importance to fish and wildlife habitat, by the Minerals Project, Office of Biological Services, U.S. Fish and Wildlife Service, Washington, DC; and/or (2) they are of considerable economic importance; and (3) data bases containing information concerning their distribution were readily available. County-level distributions of 12 of these commodities -- coal, copper, geothermal resources, gold, iron, molybdenum, nickel, oil shale/tar sands, peat, phosphate, silver, and uranium -- are depicted on Maps 1-12. The selection of only 12 minerals for mapping was based largely on the existing data bases showing reserves by county, and on funding limitations. The other four commodities -- kaolin, limestone and dolomite, sand and gravel, and zinc -- are treated only in the text.

* * *

Degradation of wildlife habitat is a common effect of mining. Disturbances can be caused by intrusions of man, vehicles and machines, odor, and noise. Deterioration of habitat may result from a combination of factors including: destruction of wetlands; increased stream sedimentation due to erosion; chemical water pollution; stream channelization and altered flood drainage; destruction of vegetation and other terrestrial habitats; and air emissions. However, after reclamation, an area may potentially have an increased carrying capacity for wildlife, especially if revegetated with mixed plant types; and surface mine lakes may provide new habitat for waterfowl and other aquatic species (NAS 1979).

This document is concerned with the location of minerals deposits and possible mining activities. Processing and transportation of minerals are not treated specifically. Specific environmental impacts associated with the mining of a particular mineral are described in the section concerning that mineral.

Certain environmental impacts are typically associated with surface and underground mining methods used for a wide variety of minerals. Mining impacts can be classified as either primary or secondary. Primary impacts are directly a result of mining activity, for example: excavation; creation of lagoons; road and facility construction; ground subsidence; gaseous emissions; dust; erosion; runoff of sediments; and chemical pollution of ground and surface waters. These can cause direct mortality, displacement of wildlife, and/or failure of wildlife to compete successfully if displaced. Secondary impacts result from the influx of people into formerly undisturbed areas. In many cases, the increased population results in urbanization, industrialization, agriculture/grazing, and recreation; these in turn can result in pollution, harassment of wildlife, and road and traffic hazards. These developments potentially can have a greater impact than the primary impacts (Horak and Olson 1980), however it is the primary impacts that will be addressed in this section.

The principal effects of mine exploration result from access roads, drill pads, and small excavations made to hold drilling fluid. More drilling, tunnelling, or shaft sinking may be done if initial prospecting is favorable. Typically, the area disturbed by a single drill site is approximately one-half of an acre, and also may include scrapings on a slope as a level site is needed. In addition drilling without proper aquifer sealing can result in the mingling of ground waters from different aquifers (NAS 1979).

A major impact of mining operations is disturbance of the land surface, especially in surface mining operations which, more than most other land uses, irreversibly change the land they occupy (NAS 1979). Surface mining, which has disturbed about 0.12% of the land surface in the the 48 conterminous states (NAS 1979), completely and dramatically destroys the existing natural communities. As a result it may be difficult if not impossible to fully restore the original contour, productivity, native vegetation, and utility to wildlife of a surface-mined area (Reznek 1977). Furthermore, reclamation of non-coal surface mines is still relatively limited, but activity is increasing as state laws come into effect (NAS 1979). Even underground mines can degrade the land surface as a result of ground subsidence and waste disposal. The amounts of land surface utilized and reclaimed by the mining industry from 1930 to 1971 are summarized in Table 2. Much of the land defined as disturbed is part of existing operations and cannot be reclaimed until mining is completed. Also, land disturbed by mineral exploration, access and haulage roads, and mills and camp sites is not included in Table 2, but this would increase the total by a maximum of only 5-10%.

The effects of surface mining on land use and landscape vary with: terrain; depth, size, and shape of the ore body; and waste/ore ratio. Removal of overburden and waste to expose the ore body and maintain safe pit slopes requires surface storage or disposal of soil and waste. Vegetation is destroyed in the pit, storage/disposal areas, and support facilities areas. Occasionally, as in sequential mining of contiguous ore bodies, a worked-out pit may be conveniently available for storage of waste from an operating pit. However, even with contiguous ore

Table 2. Approximate areas (hectares) of land utilized and reclaimed by mining activities[1] in the 48 conterminous United States, 1930-1971 (from Paone et al. 1974).

Type of use	Utilized	Reclaimed
Surface area mined (area of excavation only)	866,000	396,000
Area used for disposal of overburden and other mine waste from surface mining ..	295,000	162,000
Surface area subsided or disturbed as a result of underground workings	42,500	2,380
Surface area used for disposal of underground mine waste	76,700	8,740
Surface area used for disposal of mill processing waste	182,000	18,700
Total[2]	1,470,000	587,000

[1] Excludes oil and gas operations.

[2] Data may not add to totals shown because of independent rounding.

bodies, sequential pit opening may not be feasible because the necessity for ore grade control and resource conservation requires mining from selected parts of one or several bodies simultaneously (e.g., berrylium, clay, cement, uranium) (NAS 1979).

The primary effects of underground mining are surface subsidence and destruction of vegetation and terrain alteration by roads, support facilities, and mine waste storage. Ground collapse may be part of a planned block-caving operation, or it may occur after the completion of mining due to failure of underground support. Subsidence in level terrain is more defacing than in mountainous or rugged terrain, and it may damage roads and other structures wherever it occurs (NAS 1979).

Water management is a critical issue in the reclamation of mined land. In the west, reclamation of the land surface is especially difficult because of water availability problems. In such arid ecosystems, revegetation can occur only over very long periods of time. Several western states (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, Wyoming [USGS 1970]) have areas that receive less than the 10-inch minimum average annual precipitation required for successful revegetation. In other states, severe seasonal variation in precipitation severely limits revegetation during parts of the year. Irrigation can help but removes water from other uses (Reznek 1977).

Mining activities can have serious effects on surface and ground water resources. The potential for damage is especially severe where there is extensive exposure of ore and wall rock to an oxidizing and humid (or wet) environment. These conditions promote the formation of acids and the solubilization of metals and other chemicals. Measures to limit water entry into underground mines may fail after mining ceases, and subsidence may provide new sources of water entry. Also, improperly plugged boreholes may contribute to ground water pollution and allow inter-aquifer communication. Thus, a mine must be appropriately designed and properly operated and closed in order to minimize water quality degradation (NAS 1979). Furthermore, dewatering of mines may lower water tables, which in turn may eliminate springs and deprive vegetation of water (Horak and Olson 1980). Increased erosion due to destruction of vegetation can result in heavy siltation in surface waters; this in turn can have drastic effects on aquatic life. Finally, tailings ponds may contain toxic pollutants and oily scums that are hazards to wildlife, especially migrating waterfowl (NAS 1979).

Mining activity can also degrade air quality, primarily due to dust from roads, mine-waste piles, and pit operation, and exhaust fumes from equipment and vehicular traffic (NAS 1979).

Another potential consequence of mining is radioactive contamination. Whether this is a real threat is unknown, but radioactive emissions can occur from uranium and, to a lesser extent, phosphate mines (NAS 1979).

The timing of mining activities can influence the severity of environmental impacts. For example, at certain seasons, mining may be more likely to interfere with resting birds or the spawning of fish (Horak and Olson 1980).

Another aspect of the impact of a surface mine is simply from its presence amid neighboring, competing, and commonly incompatible land uses. The degree to which mines are, or could be, isloated by planning and zoning depends upon how large a share of the nation's land the industry requires and where the mines are located. Location in the natural resource and settlement pattern is important as it affects not only the nature of environmental control measures necessary when a mine is operating, but also the extent to which the land will be needed for other uses when it is no longer mined (NAS 1979). To quote Dick and Wimpfen (1980): "Obviously no mining system is acceptable that unduly jeopardizes the safety or health of the miners or unduly degrades the environment or both." Clearly, every mining operation will cause some degree of environmental degradation. What must be determined is whether that degradation is significant and thus unacceptable, or if it can be mitigated by sound advance planning.

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Coal

Coal is the compressed and altered residue of plants that grew in ancient freshwater and brackish-water swamps. Accumulated plant remains first became peat and were than transformed into coal via diagenesis followed by metamorphism. Of coal consumed annually in the United States, about 62% is used in the production of electricity, 20% is used by the steel industry, and 16% is used by the manufacturing industry (Brobst and Pratt 1973). Coal also has a great potential for use as a raw material in the production of synthetic gas, liquid fuel, and lubricants (Brobst and Pratt 1973; USBOM 1976).

In ascending order of rank (fuel quality), coals are classified as lignite, subbituminous, bituminous, and anthracite. Rank increases as amount of fixed carbon increases and amounts of moisture and volatile matter decrease. Bituminous coal is the most abundant and widespread rank of coal in the United States. Except for some mine rock and anthracite ash, which have been used in the manufacture of lightweight building aggregates, there are no important byproducts or coproducts from the mining and use of anthracite. The carbonization of the other ranks of coal produce three basic coal chemicals -- ammonia, light oil, and tar. Ammonia can be recovered as an aqueous solution or reacted to form ammonia compounds. Coal tar can be processed further to obtain phenols, cresols, naphthalene, and pitch, while the fractional distillation of light oil yields benzene, toluene, xylenes, and solvent naphtha. Some fly ash and bottom ash from burning of coal are also used in manufacture of bricks and lightweight aggregate, and some boiler slag is used in road-building materials (USBOM 1976).

The total domestic production of coal in 1978 was approximately 659 million tons, of which about 654 million tons were bituminous and lignitic coals and about 5 million tons were anthracitic coals (Anon. 1980). As of 1977, 97% of active coal mines in the United States were in 11 eastern states (FWS 1977a). All anthracite production in the United States came from 11 counties in northeastern Pennsylvania. Identified Pennsylvania anthracite resources, representing about 96% of total domestic anthracite resources, were estimated to be 18.6 billion tons as of 1974; 7.1 billion tons of these resources are considered to be mineable by conventional surface and underground methods, with a recoverability of between 40% and 90%. Only 90 million tons of anthracite are in deposits that can be strip mined. Demonstrated domestic reserves of bituminous and subbituminous coals are 293 billion tons of underground deposits and 109 billion tons of surface-mineable deposits (USBOM 1976). Strip mining can obtain essentially 100% of coal in place, while underground mining on the average recovers approximately 50%. However, if only half of the estimated total reserves is recovered, the amount of energy available from coal is still enormously greater than the total available from oil and gas (NAS 1975). Other resources, which are not presently economically recoverable, are estimated to be approximately 3.5 trillion tons of all ranks of coal (USBOM 1976). About 50% to 70% of the U.S. coal resources are located in the Northern Great Plains and Rocky Mountain Coal Provinces, especially in Wyoming, South Dakota, North Dakota, and Montana (Reznek 1977).

Serious environmental problems have faced and will continue to face the development of coal resources. These factors are especially serious to the anthracite industry, which has already suffered a decline as a result of increased costs due to unfavorable geological and other physical conditions (Horak and Olson 1980). Among these environmental impacts are land surface subsidence from underground mining operations and pollution of ground and surface waters by mine drainage (USBOM 1976).

However, the central issue of surface coal mining is environmental aesthetics. Since the use of coal is predicted to double or triple by the year 2000, there is a great potential for the disturbance of a vast amount of land. For example, in the eight-state Western Coal Province (Arizona, New Mexico, Utah, Colorado, Montana, Wyoming, North Dakota, and South Dakota), 43% of the coal is within 225 feet of the surface, and thus surface mining methods can be applied (Reznek 1977). By 2000, strip mining for coal is expected to impact more than 8 million hectares (approximately 20 million acres) across the United States (Horak and Olson 1980).

Map 1 (Figure 4). Estimates of coal reserves were obtained from a U.S. Geological Survey data base (Hamilton et al. 1975; Thomson and York 1975). The file contains tonnages of coal compiled by county and coalbed. Sulfur, ash, BTU, and other properties are given for each coalbed. The coalbeds were aggregated to county units and the relative amount of coal reserves was classified as small (less than 1,000 tons), medium (1,000 to 100,000 tons), or large (more than 100,000 tons).

Other areas in the southeastern United States containing coal reserves of concern to FWS were defined on the basis of information provided by the FWS Regional Office in Atlanta, Georgia (Ronald J. Haynes, pers. comm.). These areas primarily contain lignite reserves.

Additional counties in Indiana and Missouri containing coal deposits of concern to FWS but not shown on Map 1 are listed in Appendix C (R. Welford, FWS, Twin Cities, MN, pers. comm.).

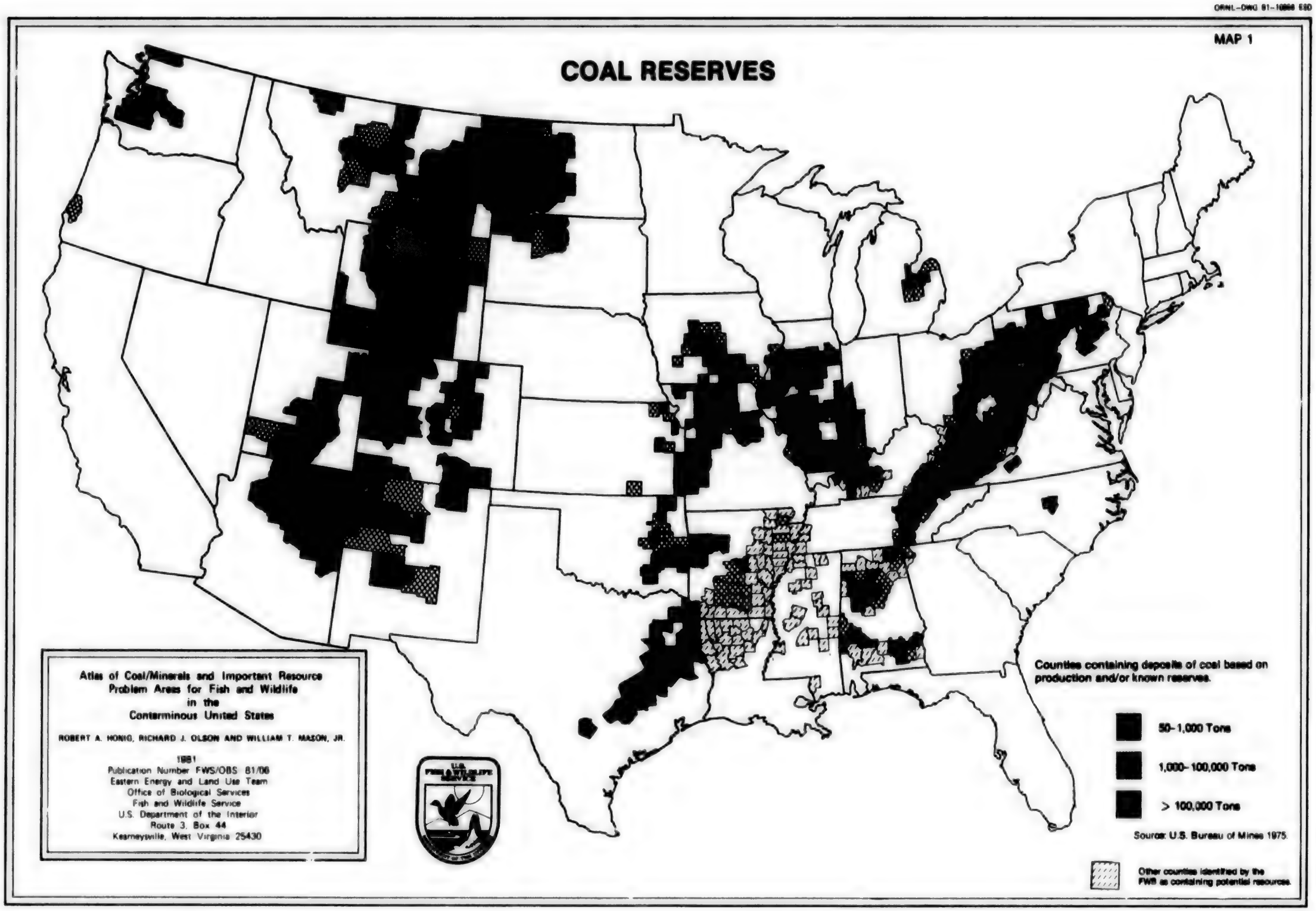

ORNL-DWG 81-10866 ESD
MAP 1
COAL RESERVES
Atlas of Coal/Minerals and Important Resource
Problem Areas for Fish and Wildlife
in the
Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR.
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
U.S. FISH & WILDLIFE SERVICE
Counties containing deposits of coal based on production and/or known reserves.
50-1,000 Tons
1,000-100,000 Tons
> 100,000 Tons
Source: U.S. Bureau of Mines 1975.
Other counties identified by the FWS as containing potential resources.

Figure 4. Counties containing coal reserves.

Copper

Copper is utilized in its pure metallic state and in alloys with other metals. It has high electrical and thermal conductivity, ductility, malleability, resistance to corrosion, strength, and lack of magnetism. As such, it is put to innumerable industrial uses. About half of the domestic copper use in 1970 was for electrical applications. Other major uses were in construction, industrial machinery, transportation, and ordnance. If it were not for the increasing substitution of aluminum, and to a lesser extent stainless steel, for copper in numerous applications, the need for copper would exceed its available supply (Brobst and Pratt 1973).

Copper ores may contain significant recoverable quantities of other metals such as gold, silver, molybdenum, cobalt, zinc, lead, nickel, sulfur, tellurium, selenium, rhenium, palladium, platinum, arsenic, and iron. In addition, many ores mined chiefly for other metals contain recoverable copper (Brobst and Pratt 1973).

In recent years, open pit mining has accounted for about 90% of the production of copper ore (USBOM 1976). Several Arizona copper deposits are being mined by in-place leaching methods, which have much less environmental impact than the more common open-pit techniques. After fracture by explosive or hydraulic methods, copper is leached by sulfuric acid, pumped to the surface, and removed electrolytically. However, only 50-60% of the copper is recoverable by these methods, and all of the byproduct metals (e.g. gold, molybendum, selenium) are left in the rock during leaching (Brobst and Pratt 1973).

Surface restoration of areas mined for copper is very difficult due to the finely powdered mill tailings and a high ratio of waste to produced metal. Water pollution by mine waste is a problem, especially because many large copper deposits are in arid regions making adequate water supplies increasingly difficult to obtain (Brobst and Pratt 1973).

Copper occurs in at least 160 minerals, the most abundant being chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), and chalcocite (Cu_2S) (Brobst and Pratt 1973). Copper produced as a byproduct from nickel deposits makes a significant contribution to the supply. Such deposits can be found in Minnesota and, although not mineable at present, represent a very important future copper resource (USBOM 1976).

Porphyry copper deposits in the southwestern United States (see Map 2) make up a significant portion of the world's identified copper resources. The western United States also contains some of the most important hypothetical copper reserves (Brobst and Pratt 1973). Other copper deposits are scattered throughout the Appalachian Mountains and near Lake Superior (USBOM 1976; Barr Engineering Co. et al. 1980). The identified resources in the United States as of 1975 are 90 million tons of copper ore, with an additional 320 million tons available in other resources (USBOM 1976). The greatest likelihood of new discoveries, based on geological evidence, is in the southwest. A possibility of finding large deposits in the Appalachians still remains (Brobst and Pratt 1973). Principal copper producing states in 1979 were Arizona (65%), Utah (13%), New Mexico (12%), Montana (5%), and Michigan (3%). Domestic production of copper in 1979 was 1.43 million metric tons (USBOM 1980).

Map 2 (Figure 5) and comments pertaining to Maps 4-7, 11. Data on deposits of the six metallic minerals -- copper (Map 2), gold (Map 4), iron (Map 5), molybdenum (Map 6), nickel (Map 7), and silver (Map 11) -- were obtained from the USGS National Atlas Minerals File. This computerized file indicates the relative amount (high, medium, or low) based on past production, current activity, and estimated reserves for deposits within mining districts. These data were used to compile the mineral maps in The National Atlas of the United States of America (USGS 1970, pp. 178-180). The recently updated files were provided by R. A. Weeks, USGS retired, who compiled the National Atlas minerals maps.

Mining districts were cross-referenced to counties. Often several mining districts occur within a county with each district containing deposits of a particular mineral. However, since the data set indicates only relative amounts within mining districts, it was not possible to classify counties according to relative importance. It is unclear whether a county with two medium or three low level deposits was as important for future mining activity as a county with a single high level deposit. Therefore, counties were simply tabulated as having a mineral present or not. The maps do not distinguish between major ore deposits which may be actively mined, and minor occurrences which may never be mined due to economic considerations.

Additional counties in Missouri containing copper deposits of concern to FWS but not shown on Map 2 are listed in Appendix C (R. Welford, FWS, Twin Cities, MN, pers. comm.).

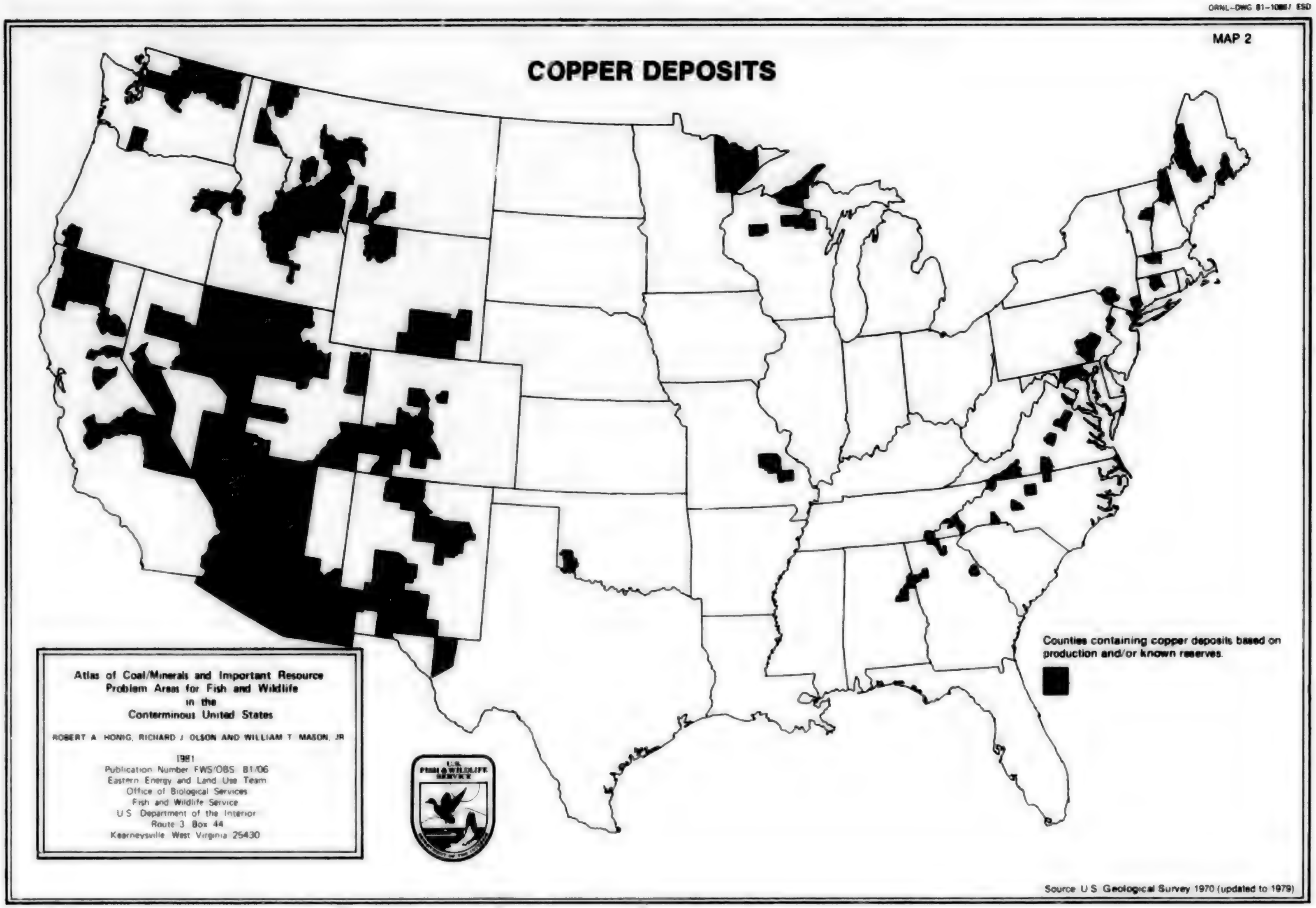

ORNL-DWG 81-10867 ESD
MAP 2
COPPER DEPOSITS
Counties containing copper deposits based on production and/or known reserves.
Atlas of Coal/Minerals and Important Resource
Problem Areas for Fish and Wildlife
in the
Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
Source U.S. Geological Survey 1970 (updated to 1979)

Figure 5. Counties containing copper deposits.

Geothermal Resources

The principal use of geothermal energy is in the generation of electricity. Other uses are space heating, air conditioning, agricultural heating, water desalinization, drying, aquaculture, and the processing of paper, diatomite, and salt. Byproducts of geothermal energy utilization include dry ice, boron, and calcium chloride (Brobst and Pratt 1973; Suter 1978).

The geothermal resource base is defined as all the heat above 15°C in the earth's crust (Brobst and Pratt 1973). Only a small fraction of this heat can be properly considered a resource as most of the geothermal heat is far too diffuse to ever be recovered economically. However, economically useful concentrations of geothermal energy occur locally in restricted volumes. In such "hot spots," high temperatures (65° to 340°C) are found in porous rock containing liquid water and/or steam (Godwin et al. 1971; Brobst and Pratt 1973). The energy in a geothermal reservoir is stored in rocks and to a lesser extent liquid water and/or steam-filled pores or factures. The water and steam provide the means of heat convection from deep sources to shallow depths. Where liquid water is present, it is held at temperatures above the surface boiling point by the confining pressures. Geothermal reservoirs are found in regions of recent vulcanism and mountain building and in the deep parts of many sedimentary basins (Godwin et al. 1971). The geothermal resources of the United States are roughly estimated as being between 10^{18} and 10^{25} calories (Brobst and Pratt 1973).

Three types of geothermal resources are or may soon be used as energy sources: hydrothermal; geopressured; and hot, dry rock. Hydrothermal resources consist of steam or water heated by volcanic material that has intruded into the earth's mantle. Most of the hydrothermal resources in the conterminous United States are located in the tectonically active areas of the west. With the exception of the heavily agricultural Imperial Valley, California, most of these occur in areas of low population density. Geopressured resources consist of trapped hot water that has prevented full compaction of the rock formation and supports much of the overburden weight. Hot, dry rock resources consist of areas with higher than normal heat flow gradients but no suitable aquifer (Suter 1978).

In general, geothermal energy generation has a far lower environmental cost than nuclear or fossil-fuel processes. Normal drill pad construction for geothermal operations requires 2-6 acres. These pads are routinely constructed as multi-well pads (3-6 wells). Geothermal energy generation produces only a fraction of the atmospheric particulate pollutants as do fossil-fuel plants and emits small, non-harmful amounts of Rn^{222}, a radioactive isotope of radon (W. M. Spaulding, Jr., Ecological Services, FWS, Washington, DC, pers. comm.). However, carbon dioxide, usually the predominant noncondensible gas in geothermal fluids, may contribute to climatic warming via the "greenhouse effect." Toxicity due to hydrogen sulfide is only a problem in confined spaces, and conversion to SO_2 (sulfur dioxide) may increase SO_2 concentrations downwind. Mercury is also present in most geothermal fluids (Suter 1978). Waste heat from geothermal resources is a potential thermal pollutant. Some hydrothermal fluids contain high solute concentrations which may pose a chemical pollution hazard to surface and ground waters. Ground subsidence, due to fluid withdrawal or thermal contraction may also occur (Brobst and Pratt 1973; Suter 1978).

Map 3 (Figure 6). Geothermal resource areas were classified as having potential water temperatures greater than 150°C, 90-150°C, or less than 90°C. The hydrothermal convection systems have reservoir temperatures greater than 90°C within 3 km of the surface; all of these areas occur in the west. Geothermal areas in the west having potential for development were defined from a 1:2,500,000-scale map (SAI 1980a). If a county had several levels of potential resources the county was classified according to the hottest resources indicated. The thermal waters (water less than 90°C within 1 km of the surface) are potential sources of low-grade thermal energy; however, areas favorable for development of these resources are not well defined (Muffler 1979). Locations of areas in the east most favorable for discovery and development of local sources of low temperature thermal water were obtained from USGS Circular 790 (Muffler 1979).

Other areas in New Mexico containing geothermal resources of concern to FWS were defined on the basis of information supplied by the FWS Regional Office in Albuquerque, New Mexico (Joseph W. Kathrein, pers. comm.).

ORNL–DWG –81–10866 ESD

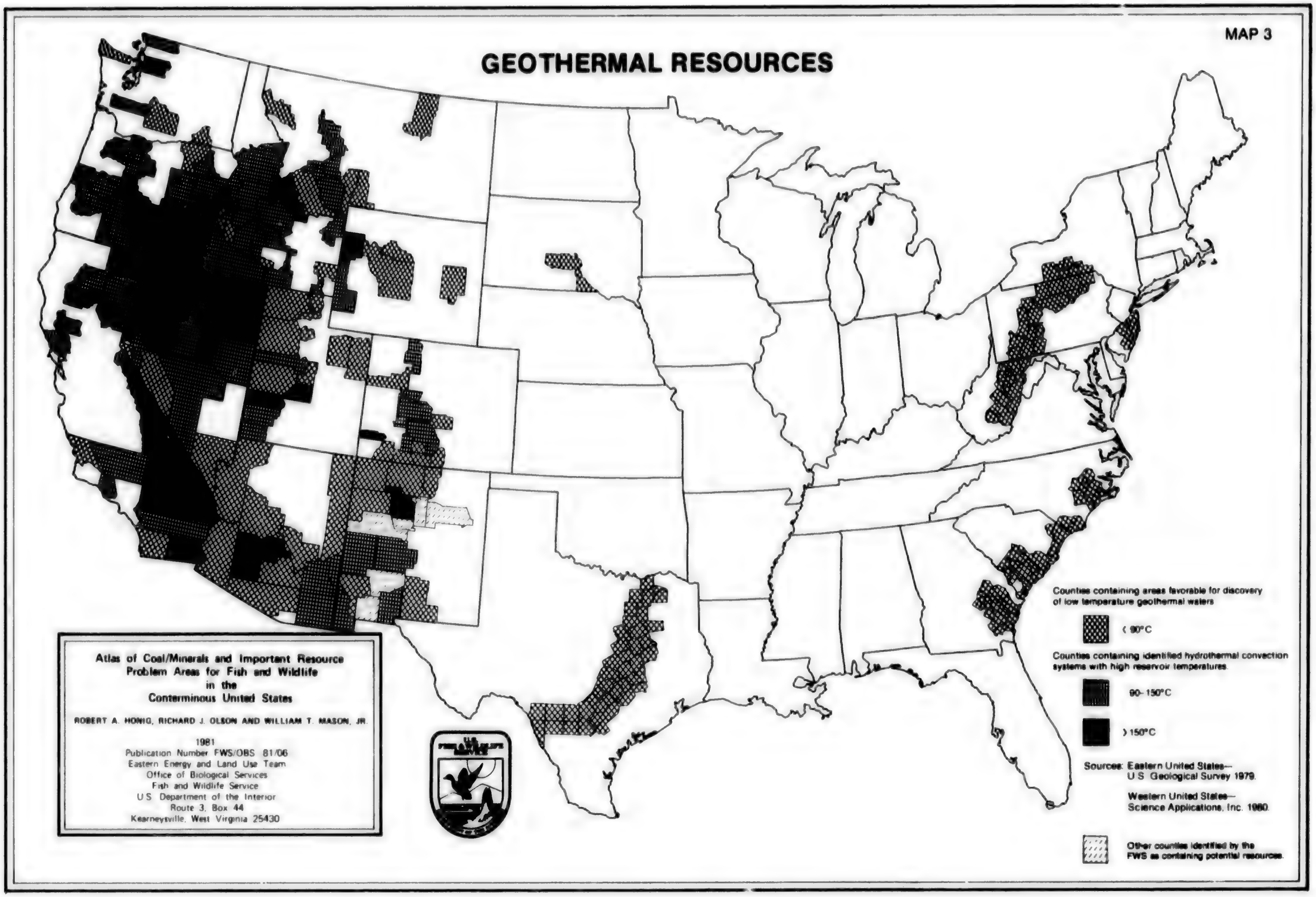

MAP 3
GEOTHERMAL RESOURCES
Atlas of Coal/Minerals and Important Resource Problem Areas for Fish and Wildlife in the Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR.
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
Counties containing areas favorable for discovery of low temperature geothermal waters
▩ < 90°C
Counties containing identified hydrothermal convection systems with high reservoir temperatures.
▩ 90–150°C
■ > 150°C
Sources: Eastern United States— U.S. Geological Survey 1979.
Western United States— Science Applications, Inc. 1980.
▨ Other counties identified by the FWS as containing potential resources.

Figure 6. Counties containing geothermal resources.

Gold

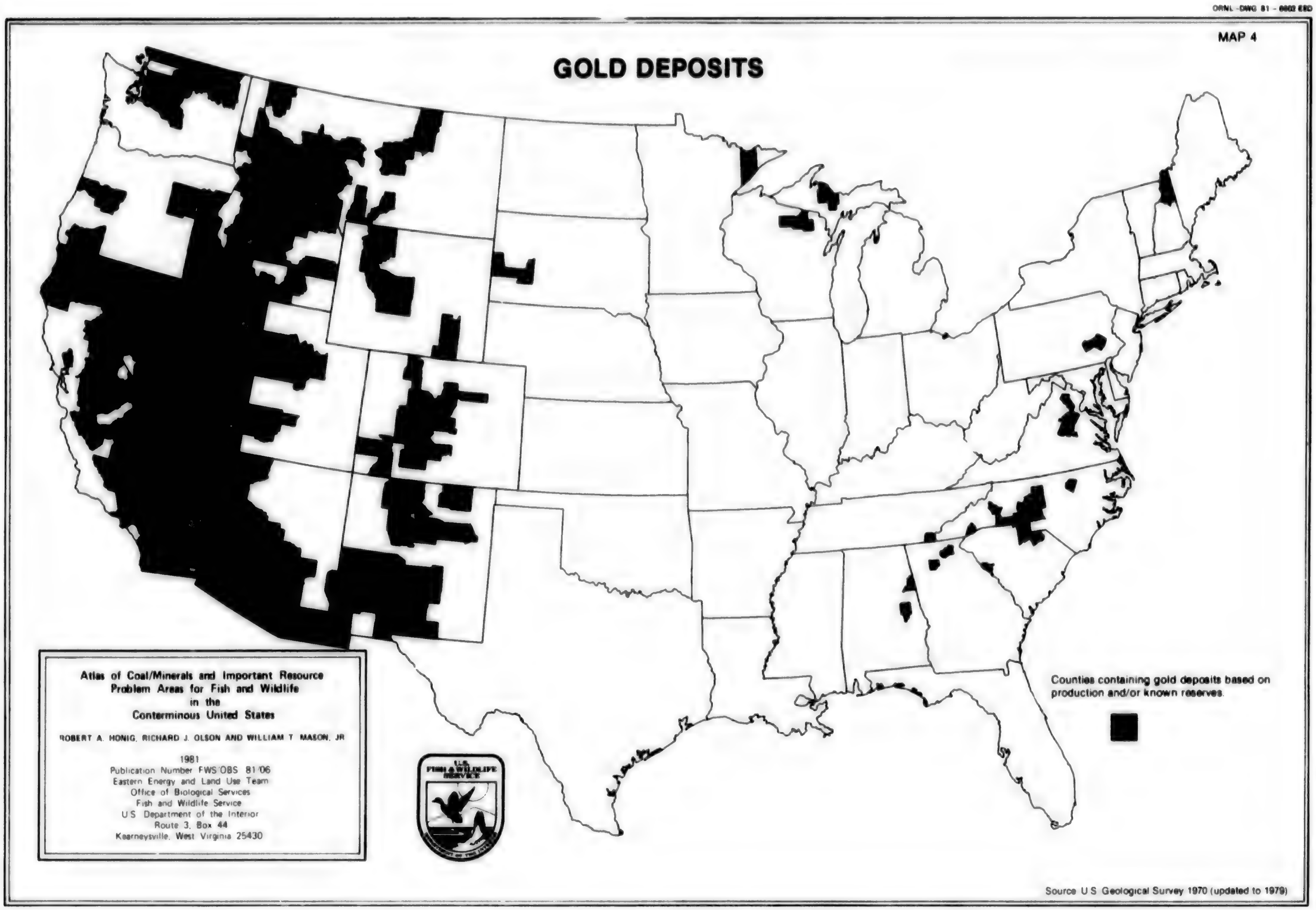
Gold has been treasured since ancient times for its beauty and permanance and in the twentieth century has emerged as an essential industrial metal. Most gold used in industry is in the form of metal or metal alloys (17). Gold has been traditionally used in the manufacture of jewelry and in dentistry; more recently it has been used widely in the aerospace, electronics, and computer industries (Brobst and Pratt 1973). Specialized gold compounds are made for a diversity of uses, for example in medicines and glass. Because of the role of gold as the principal medium of monetary exchange, about half of the world's supply of gold has been immobilized by agreement between major industrialized countries (USBOM 1976). This has been a significant factor in the recent soaring gold prices.

The world production of gold is dominated by the Republic of South Africa which annually has produced over half of the world's total output over the last 15 years (Brobst and Pratt 1973; USBOM 1980). Nearly all gold mines in the United States are in the west (USBOM 1980), primarily South Dakota, Nevada, Utah, and Arizona. About 50 to 60% of United States gold production comes from gold ores, with the remainder being a byproduct of copper and other base metal production. Silver, because of its association with gold in nature, is a coproduct of virtually all gold mining. Gold is also recovered from nickel, copper, and platinum mining. Other byproducts and coproducts of gold are mercury, zinc, lead, sand and gravel, platinum, palladium, tungsten, fluorine, uranium, and osmiridium (USBOM 1976).

About one-third of domestic gold production comes from a deep underground mine in South Dakota operated by the Homestake Mining Company. Most of the remainder is produced from open pit mines. Placer mining by dredging of large alluvial or marine deposits may once again become an important source of gold in the future (USBOM 1976).

Current U.S. gold reserves are estimated at 120 million ounces, with an estimated 120 million ounces of other resources (USBOM 1976).

Map 4 (Figure 7). See section on Copper for discussion of the map data base.



ORNL-DWG 81-6602 ESD
MAP 4
GOLD DEPOSITS
Counties containing gold deposits based on production and/or known reserves.
■
Atlas of Coal/Minerals and Important Resource Problem Areas for Fish and Wildlife in the Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
U.S. FISH & WILDLIFE SERVICE

Source U.S. Geological Survey 1970 (updated to 1979)

Figure 7. Counties containing gold deposits.

Iron

Iron is an abundant, readily extractable metal and is the metal that is most widely used by man. It has strength, hardness, and durability combined with properties that make possible fabrication into a multitude of forms. Alloying of iron and other elements into steels, in which the desirable properties of iron are enhanced, has greatly increased its usefulness. Iron and steel are used as structural components and mechanical elements and in tools, containers, and fasteners (Brobst and Pratt 1973). Most of the iron ore not manufactured into iron metal and steel is used in the production of heavy-media materials, mainly for coal preparation plants, and for cement. Smaller amounts are used in the manufacture of ferroalloys, paint, high-density concrete aggregate, ferrites, and as a mineral additive to animal feeds. Byproducts of U.S. iron mining operations include manganese, titanium, phosphate (apatite), copper, and small quantities of silver and gold (USBOM 1976).

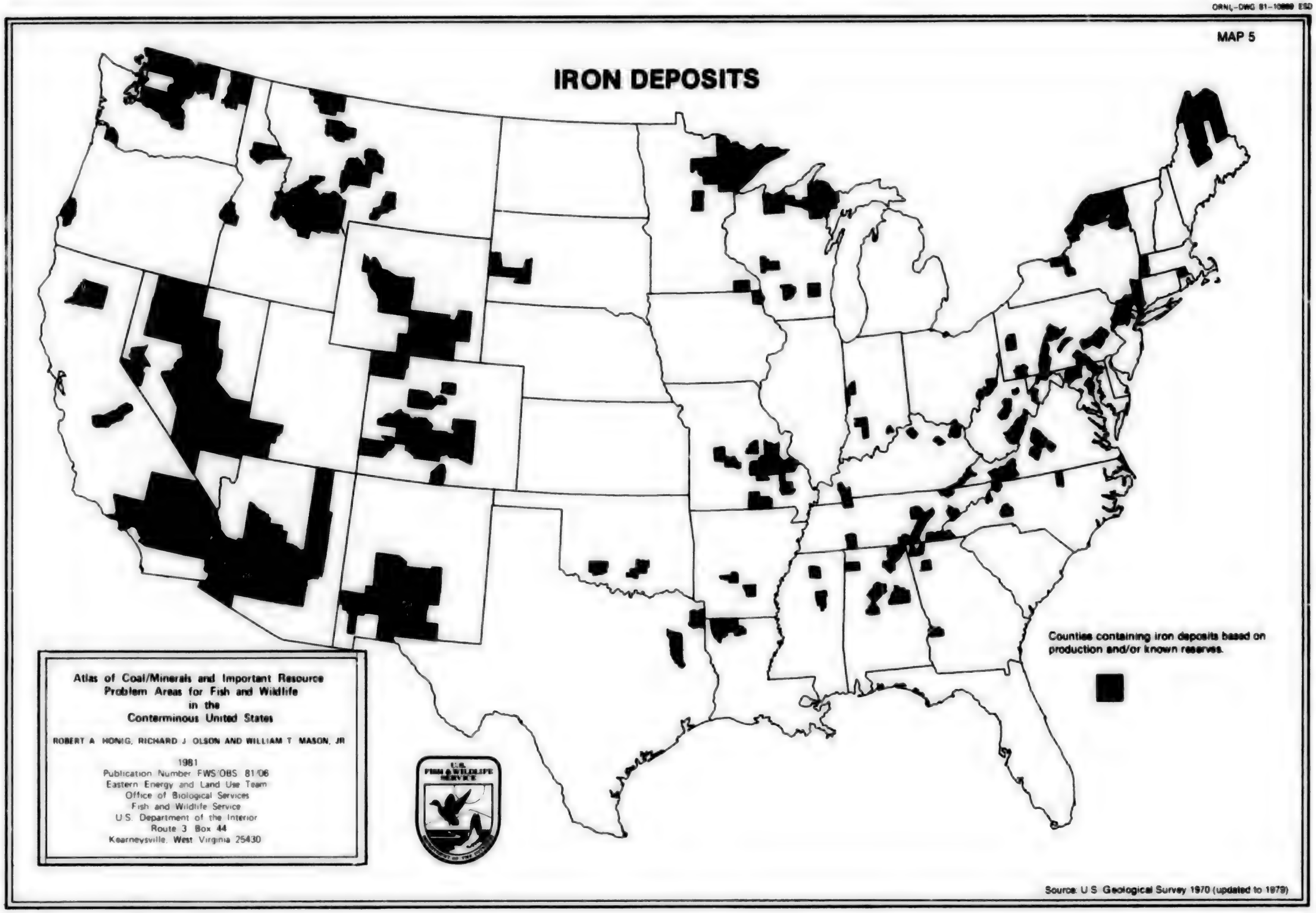
Most iron ore is mined in open pits since most commercial ore bodies lie close to the surface and have large lateral dimensions. Underground methods are used for mining narrow, steeply dipping, or deep ore bodies. However, high costs and limited production capacity have reduced the ability of underground operations to compete with open pit mines (USBOM 1976).

The United States annually produces more than 80 million tons of iron, of which about 80% is from the Lake Superior region (Brobst and Pratt 1973; USBOM 1980; Barr Engineering Co. et al. 1980). Identified, economically extractable reserves in the United States amount to 4 billion tons, with another 14 billion tons of identified resources that may become profitable under future economic conditions (USBOM 1976). United States iron reserves and potential resources are sufficient to meet domestic needs for many decades. However, due to economic considerations, the United States is a net importer of finished steel and iron ore (Brobst and Pratt 1973).

The environmental problems specifically associated with iron ore mining are primarily related to scale: the mines and recovery plants are huge. Many open pit mines in the Lake Superior region are a mile or more wide, several miles long, and several hundred feet deep. Large masses of waste material, frequently two to three times that of the ore mined, must be disposed of. The waste has been frequently left in unsightly piles adjacent to the mine rather than being returned to the mine pit. The pits themselves can become manmade lakes if proper reclamation methods are employed (Brobst and Pratt 1973).

Map 5 (Figure 8). See section on Copper for discussion of the map data base.

Additional counties in Missouri containing iron deposits of concern to FWS but not shown on Map 5 are listed in Appendix C (R. Welford, FWS, Twin Cities, MN, pers. comm.).


ORNL-DWG 81-10869 ESD
MAP 5
IRON DEPOSITS
Atlas of Coal/Minerals and Important Resource
Problem Areas for Fish and Wildlife
in the
Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR
1981
Publication Number FWS/OBS 81/06
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Route 3 Box 44
Kearneysville, West Virginia 25430
U.S. FISH & WILDLIFE SERVICE
Counties containing iron deposits based on production and/or known reserves.
■

Source: U.S. Geological Survey 1970 (updated to 1979)

Figure 8. Counties containing iron deposits.

Kaolin

Kaolin, or China clay, is a clay-like material approximating the mineral kaolinite; the term encompasses the other kaolin-group minerals, such as halloysite and dickite. Kaolin is a unique industrial material because it is chemically inert over a relatively wide pH range, is white, has good hiding power when used as a pigment or extender in coated films and filling applications, is soft and nonabrasive, has low heat and electrical conductivity, and costs less than most competing materials (USBOM 1976). Kaolin is easily dispersible and can be fired at high temperatures without warping or changing color (Brobst and Pratt 1973). The major domestic uses for domestic kaolin in 1979 were as a filler or coating for paper (43%), as refractories (15%), and in the manufacture of rubber (9%) (USBOM 1980). Minor uses include pottery, dinnerware, stoneware, white cement, catalysts in petroleum cracking (Brobst and Pratt 1973), fiberglass, paints, and plastics (FWS 1977a). In some locations, silica glass sand, muscovite, and bauxite are byproducts or coproducts of kaolin mining (Brobst and Pratt 1973; USBOM 1976).

Domestic production of kaolin in 1979 was about 8 million tons (USBOM 1980). Georgia and South Carolina are the major producers, with smaller quantities produced in Alabama, California, Florida, Idaho, North Carolina, Pennsylvania, Texas, and Utah. Reserves of kaolin in the coastal plain of Georgia, Alabama, and Mississippi are estimated to contain more than 300 million tons while other deposits are scattered throughout the Appalachian region. The nation's total kaolin resources, which contain a much higher percentage of impurities than the reserves, are estimated to be at least 5 billion tons. These resources include deposits in North Carolina, California, Washington, Idaho, Utah, and Nevada (Brobst and Pratt 1973).

Most kaolin is surface-mined, thus introducing the potential for aesthetic impacts, dust, and sedimentation in surface waters. Some kaolin deposits are exploited by hydraulic mining and dredging. Recovery is near 100% of the mineable beds in open pit mines, and the waste-to-kaolin ratio is generally about 7:1 (USBOM 1976).

Limestone and Dolomite

Limestone is composed of the mineral calcite ($CaCo_3$) and dolomite is composed of the mineral dolomite ($CaMg(CO_3)_2$). However both are called limestone by the industry, and intermediate varieties are not distinguished. Some newly deposited limestone is composed of the mineral aragonite, which has the same chemical formula as calcite and gradually changes to calcite over time. Calcite and dolomite commonly occur in the same rock, but generally one predominates in any one stratigraphic layer (Brobst and Pratt 1973).

Limestone is used chiefly in the production of construction stone, which consumed nearly two-thirds of U.S. limestone production in 1969, and portland cement, which consumed about 15% of domestic production. Fluxes, for blast and open-hearth furnaces, and the manufacture of lime consumed another 5% each, while agricultural limestone accounted for about 4% of consumption (Brobst and Pratt 1973). Limestone is also used in the manufacture of glass and for sulfur dioxide removal from stack gases at power plants (NAS 1980a). More than 628 million tons of limestone and dolomite were used in the United States in 1969 (Brobst and Pratt 1973).

Limestone and dolomite formations are widespread in the United States, and nearly every state has deposits that are adequate for construction and other uses not requiring chemically pure stone. High-purity carbonate rock formations are far less widely distributed than impure carbonate rocks. However, some high-purity formations are widespread, occurring in mineable thicknesses nearly continuously over areas of many hundreds, and sometimes thousands, of square miles. Limestone resources are large and are expected to supply domestic needs for hundreds, or even thousands, of years (Brobst and Pratt 1973).

Exploitable limestone and dolomite formations occur most extensively in the slightly deformed rocks of the mid-continent, especially in Kentucky, Tennessee, Missouri, and states adjacent to the Great Lakes. Furthermore, in the Appalachian Plateaus and the plateau regions of the western United States there are relatively flat layers of limestone and dolomite at mineable depths over wide areas. High purity limestone is found in central Pennsylvania, western and southwestern Virginia, and the eastern panhandle of West Virginia. The eastern panhandle of West Virginia also contains deposits of high-purity dolomite, as does western Ohio, which is the chief source of high-purity dolomite (Brobst and Pratt 1973). Limerock is also being mined extensively in south Florida in the conservation area between Miami and the Everglades (Ronald J. Haynes, Regional Office, FWS, Atlanta, GA, pers. comm.).

The environmental impacts of limestone exploitation are essentially the same as those associated with sand and gravel mining. In addition, there is evidence that mining operations involving carbonate rocks may cause elevations in alkalinity of surface waters (NAS 1980a).

Molybdenum

Molybdenum is important as an alloying metal, imparting increased hardness, toughness, and corrosion resistance to iron, steel, and stainless steel. It is an essential alloying metal in the manufacture of superstrength steel for heavy construction, such as in skyscrapers and bridges. A small percentage of molybdenum is used as molybdenum metal and in pigment, catalysts, agriculture, chemicals, and lubricants (Brobst and Pratt 1973). Molybdenum is mined by open pit and a variety of underground methods (USBOM 1976).

Molybdenum is virtually the sole metal of which the United States is a net exporter (Brobst and Pratt 1973). Domestic production in 1979 was just over 140 million pounds (USBOM 1980) amounting to about 60% of the world's production (Brobst and Pratt 1973). Domestic consumption in 1970 was approximately 74 million pounds (USBOM 1980).

About half of the world's molybdenum resources are in the United States. Most of the identified resources in the United States occur in Colorado and New Mexico (Brobst and Pratt 1973). The total identified resources in the United States amount to approximately 35 billion pounds (Brobst and Pratt 1973; USBOM 1976). Large quantities of molybdenum are probably still hidden in areas of known deposits. An estimate of such hypothetical resources amounts to about 1 billion tons worldwide, with about 500 million tons located in the United States (Brobst and Pratt 1973).

Molybdenum does not occur in nature in a pure metallic state. It is found only in combination with other elements such as sulfur, oxygen, tungsten, lead, uranium, bismuth, iron, magnesium, cobalt, vanadium, and calcium. Minerals of current economic importance are molybdenite (molybdenum disulfide, MoS_2) and to a lesser extent ferimolybdite ($FeMoO_3H_2O$) and jordisite (amorphous molybdenum disulfide) (Brobst and Pratt 1973). Molybdenum is recovered as a byproduct of copper, tungsten, and uranium ores; and iron, rare earths, sulfur, tin, and tungsten are byproducts of molybdenum ores (USBOM 1976). Presently about 25% of United States molybdenum is produced as a byproduct of copper mining (Brobst and Pratt 1973).

Map 6 (Figure 9). See section on Copper for discussion of the map data base.

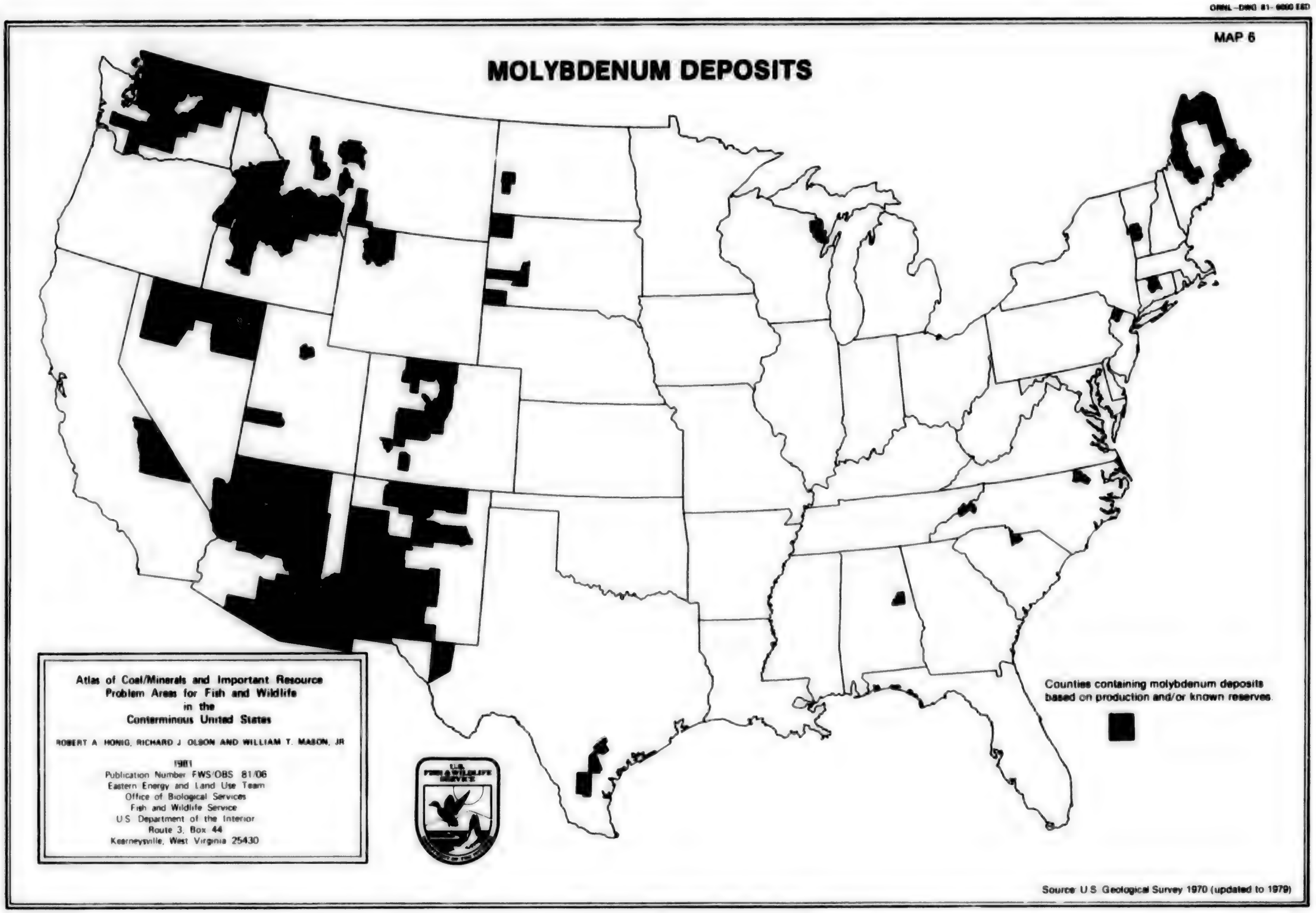

ORNL–DWG 81–9690 ESD
MAP 6
MOLYBDENUM DEPOSITS
Atlas of Coal/Minerals and Important Resource
Problem Areas for Fish and Wildlife
in the
Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
Counties containing molybdenum deposits based on production and/or known reserves
Source: U.S. Geological Survey 1970 (updated to 1979)

Figure 9. Counties containing molybdenum deposits.

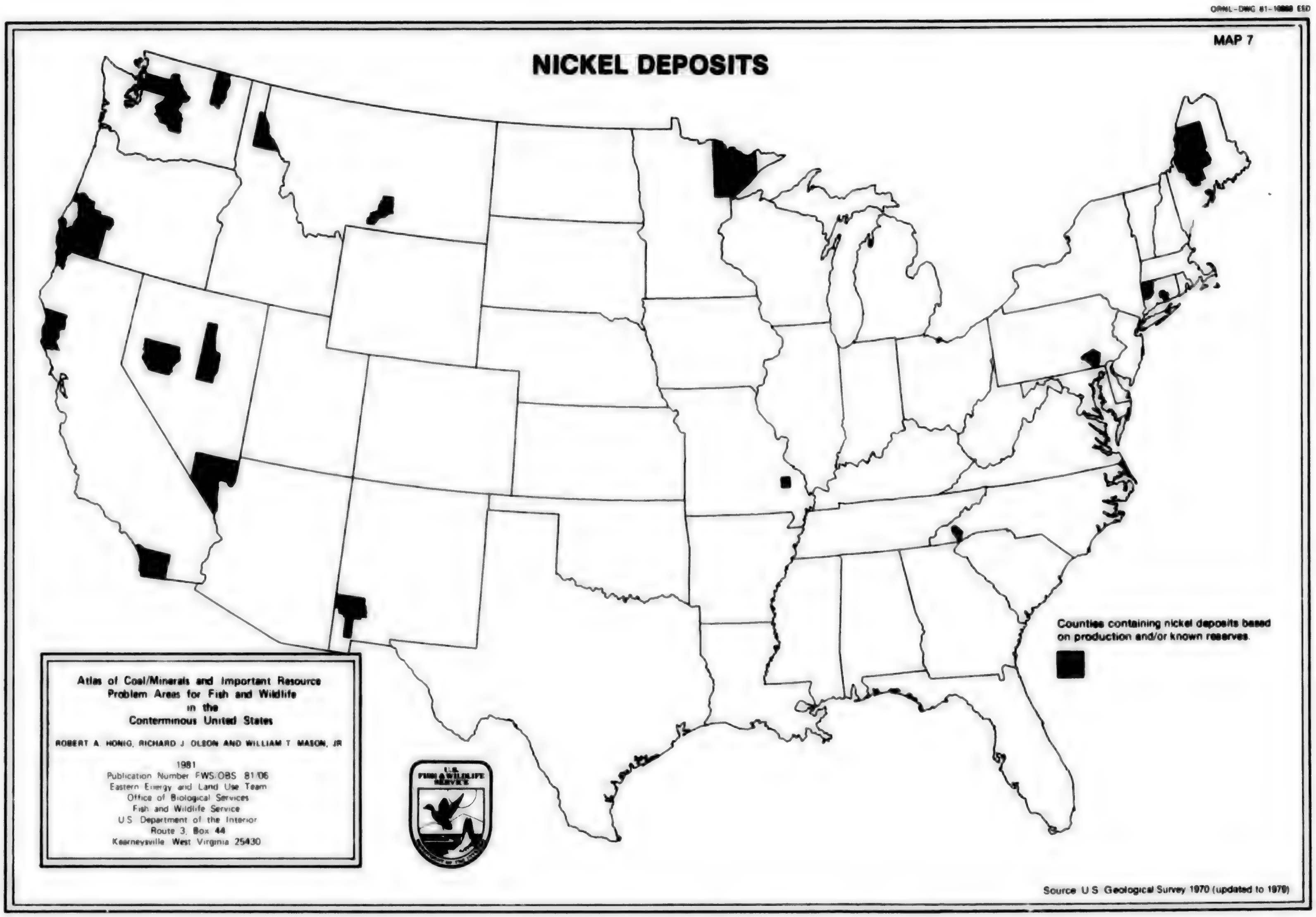
Nickel

More than 90% of nickel is used in the form of metal (USBOM 1976). The greatest value of nickel is in alloys with other elements where it adds strength and corrosion resistance over a wide range of temperatures. As such it is an essential component of the iron and steel industry (Brobst and Pratt 1973), the manufacture of superalloys for use in aircraft, and the production of various salt water resistant alloys for use in ship building. Nickel is also used in batteries, dyes and pigments, insecticides, and catalysts. Byproducts and coproducts of nickel production include copper, platinum, cobalt, silver, gold, palladium, iridium, osmium, rhodium, ruthenium, selenium, tellurium, iron, ammonium sulfate, and urea (USBOM 1976).

Nickel is mined by open pit and underground methods. The only domestic primary nickel producing mine in 1979 was an open pit mine in Riddle, Oregon (Douglas Co.), although some nickel is produced as a copper byproduct and from secondary sources such as scrap metal (USBOM 1976, 1980).

U.S. reserves of nickel are small; over 70% of consumption is imported (USBOM 1980). Identified, economically recoverable reserves in the United States total about 200,000 tons, essentially entirely at the Riddle, Oregon, deposit. Other identified resources which may become economically recoverable in the future total about 15 million tons. Ocean nodules may also represent a potential resource if processing and mining technologies are developed (USBOM 1976).

Map 7 (Figure 10). See section on Copper for discussion of the map data base.



ORNL-DWG 81-10888 ESD
MAP 7
NICKEL DEPOSITS
Counties containing nickel deposits based on production and/or known reserves.
Atlas of Coal/Minerals and Important Resource Problem Areas for Fish and Wildlife in the Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
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U.S. Department of the Interior
Route 3, Box 44
Kearneysville West Virginia 25430
U.S. FISH & WILDLIFE SERVICE

Source U.S. Geological Survey 1970 (updated to 1979)

Figure 10. Counties containing nickel deposits.

Oil Shale/Tar Sands

Among the materials from which synfuels (synthetic organic products) can be made are oil shale and tar sands. Oil shale is a fine-grained sedimentary rock containing kerogen, an organic substance similar to the materials which have produced naturally occurring oil and gas. High-grade shale can yield 35 gallons or more per ton of shale and may also yield recoverable sodium bicarbonate, sodium carbonate, and aluminum (Brobst and Pratt 1973; Rickert et al. 1979). Tar sands are porous sandstones containing viscous to solid petroleum unrecoverable by conventional methods (Rickert et al. 1979). Although previously not economically viable, oil shale and tar sand ventures may soon become practical due to the rising demand for new energy sources (Brobst and Pratt 1973).

Oil shale and tar sand deposits are found in all but a few states, however the resources of economic interest are concentrated in the Green River Formation of Colorado, Utah, and Wyoming (Brobst and Pratt 1973; Rickert et al. 1979; NAS 1980b). The eastern Devonian black shale, especially outcroppings, is thought to have good potential as an energy resource. The eastern deposits have the advantage of greater water availability for the mining process. Identified resources of shale oil in the United States are estimated at 2 trillion barrels in shale yielding greater than 15 gallons of oil per ton of shale (Brobst and Pratt 1973; Rickert et al. 1979). Between 400 and 600 billion barrels of the reserve are believed to be recoverable (Dick and Wimpfen 1980). The estimated amount of recoverable oil in the Green River Formation is nearly equal to the estimated total of proved and undiscovered resources of conventional petroleum in the United States (NAS 1975). The estimated reserve of tar sand oil in the United States is 29 billion barrels (NAS 1975; Rickert et al. 1979).

At present, there is no commercial production of tar sand oil in the United States (Rickert et al. 1979), however similar deposits in Canada are being mined by the open-pit method (Dick and Wimpfen 1980). Oil shale also can be mined by conventional surface mining procedures. However to eliminate the disposal problem associated with surface processing -- which produces large volumes of solid waste -- several underground (in situ) methods have been proposed. One method involves fracturing the rock, introducing heat to liquefy the kerogen, and removal of the oil via wells (Rickert et al. 1979). Modifications of this method have also been proposed. Futhermore, formation of potentially hazardous chemicals in the underground retort poses a serious threat of ground water pollution (NAS 1979).

Because mining of oil shale and tar sands is linked with on-site processing for recovery of oil, environmental problems associated with development of these minerals are somewhat unique. Unusual liquid, gaseous, and solid wastes may be produced, and the waste disposal and processing will require significant amounts of water (Rickert et al. 1979), further taxing the already overburdened western water supply. Water consumed by an oil shale processing facility probably would range from 1.5 to 4 barrels of water (possibly less for true in situ processing) per barrel of oil, depending on the location and the technology used. If water used for reclamation, power generation, and disposal of processed shale is included, up to 5 barrels of water per barrel of oil may be consumed. Consumption of 3 barrels of water per barrel of oil is realistic average estimate for surface processing (NAS 1980b).

Leachates, whether from in situ or surface operations, may cause a reduction in water quality. Futhermore waste water produced during retorting typically contains high concentrations of organic chemicals. The large land area required for solid waste disposal will alter existing land uses and wildlife habitats. Deer populations, which migrate seasonally over wide areas, will be particularly affected. Air pollutants for which no standards yet exist, such as arsenic, mercury, and selenium, may also be produced, along with carbon monoxide, hydrocarbons, nitrogen dioxide, sulfur dioxide, photochemical oxidants, and particulates. Large quantities of carbon dioxide would also be produced, potentially contributing to climatic warming due to the "greenhouse effect" (NAS 1979). Other potential environmental problems associated with oil shale/tar sands development are landslides, erosion and sedimentation, subsidence, disruption of aquifers, and acid mine drainage (Rickert et al. 1979).

Map 8 (Figure 11). The locations of the western deposits were determined by a 1:2,500,000 scale map of the area (SAI 1980b). Two reports (Janka and Dennison 1979; Booz-Allen & Hamilton Inc. 1980) were used to define the location of counties in the east containing outcroppings of the Devonian black shale. The reports contained small scale state maps defining the areas. When both reports had maps for the same state, the maps were nearly identical. The maps also showed areas of Devonian shale underlying younger rocks, though these areas were not included because of the lower probability of their being mined in the near future.

Locations of tar sands were determined from a study (Baughman 1978) that identified the counties containing deposits or included state maps showing the tar sand deposits.

Additional counties in Indiana containing oil shale deposits of concern to FWS but not shown on Map 8 are listed in Appendix C (R. Welford, FWS, Twin Cities, MN, pers. comm.).

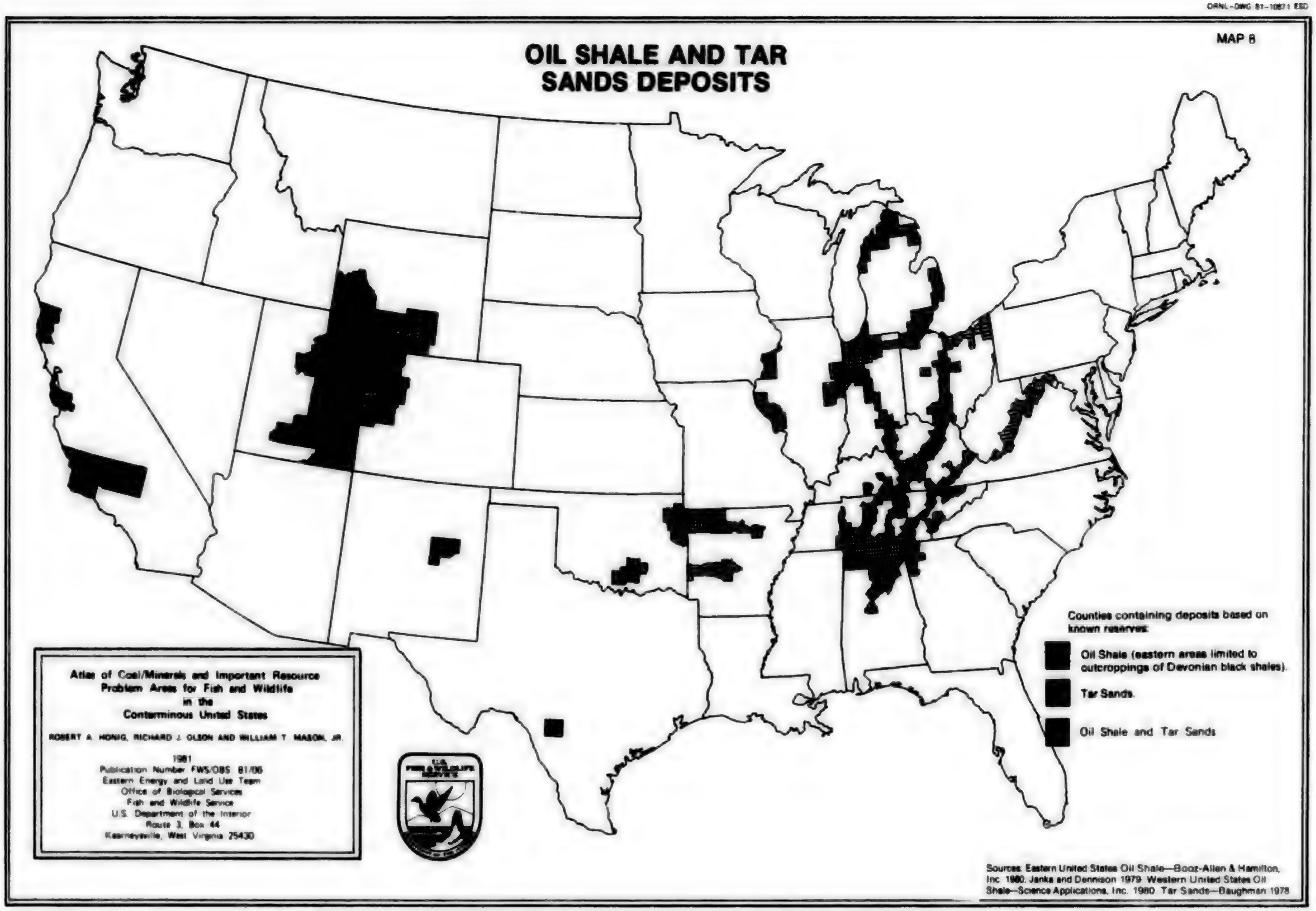

ORNL-DWG 81-10871 ESD
MAP 8
OIL SHALE AND TAR SANDS DEPOSITS
Atlas of Coal/Minerals and Important Resource Problem Areas for Fish and Wildlife in the Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR.
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
U.S. FISH & WILDLIFE SERVICE
Counties containing deposits based on known reserves:
■ Oil Shale (eastern areas limited to outcroppings of Devonian black shales).
■ Tar Sands.
■ Oil Shale and Tar Sands
Sources: Eastern United States Oil Shale—Booz-Allen & Hamilton, Inc. 1980; Janka and Dennison 1979. Western United States Oil Shale—Science Applications, Inc. 1980. Tar Sands—Baughman 1978

Figure 11. Counties containing oil shale and/or tar sands deposits.

Peat

Peat is a partially decomposed plant matter that has accumulated underwater or in a water-saturated environment. It is usually composed of 10% solid matter and 90% water. Although not classified as a coal, peat is the initial stage in the formation of coal from buried plant matter and was formerly used in the United States, and is still used in Europe, as a fuel. Since it cannot compete with the other more efficient fuels on the U.S. market, virtually all peat consumed domestically is used for agricultural and horticultural purposes. Ninety percent of domestic peat sold in 1974 was for domestic soil improvement to be used specifically in landscaping, as a base for lawns and golf courses, for mulching and improving soils, and by nurseries and greenhouses. Other potential uses of peat are as a filtering agent to remove pollutants from water, as an absorbant in oil spill cleanup, as a light and insulative building material, and as a raw material for wood alcohol distillation (USBOM 1976).

Virtually all peat in the United States is extracted by machinery; however, methods and equipment differ greatly depending on the characteristics of the deposits. In general, the peat is either cut out of or scraped from the surface. Most operations employ conventional excavating and earthmoving equipment, sometimes modified specifically for extracting peat. Where it is impractical to drain a peat deposit which is covered by water, specially adapted equipment, such as dredges and clamshells, is used (USBOM 1976).

The peat resources of the conterminous United States are on roughly 19 million acres (FWS 1977b) in 42 states and amount to 13.8 billion tons. Approximately 90% of this total is located in Minnesota, Wisconsin, Michigan, and Florida. More than half of the resources in the conterminous United States are located in Minnesota with recoverable reserves estimated at almost 7 billion tons covering more than 5 million acres. More than three-fourths of the Minnesota peat resource are located in Beltrami, Koochiching, Itasca, and St. Louis counties in the northern portion of the state (USBOM 1976). Only 2.7%, or approximately 200,000 acres, of the peatland acreage in Minnesota is currently being used (FWS 1977b). It should also be noted that the cool moist climate and irregular terrain of Alaska favor the formation of all types of peat deposits (Brobst and Pratt 1973).

Estimated United States peat production in 1979 was 880 tons. Domestic peat production is concentrated in Michigan, Florida, and Illinois, in order of volume. These three states account for about 60% of the total U.S. output, with roughly 30% of total production in Michigan (USBOM 1980). Indiana, Pennsylvania, and New Jersey also produce significant amounts. About one-third of the peat consumed in the United States is imported, with Canada supplying approximately 95% of that amount (FWS 1977a).

Peatlands are part of a group of wetlands as classified by the U.S. Fish and Wildlife Service (Cowardin et al. 1979). As such they are very important wildlife habitats. For example, the Minnesota peatlands support populations of waterfowl, muskrat, beaver, and river otter, and they are very important habitat for spruce grouse, ruffed grouse, sharp-tailed grouse, bear, moose, timber wolf, bobcat, and lynx (FWS 1977b). Thus, extensive development of peatlands has a potential for significant impacts on wildlife due to habitat alteration.

Map 9 (Figure 12). Locations of Class I and II peat resources were determined from a series of small scale state maps contained in two reports (King et al. 1980; Radian Corp. 1980). The nine states included in these reports contain the majority of peat resources in the conterminous United States. The reports define three classes of peat deposits. Class I areas have the highest potential for "fuel grade" peat which occurs in significant quantities to supply the needs of a large facility such as a 250-million cubic feet-per-day synfuels plant. The deposits usually cover areas greater than 200 square miles. Class II areas have known peatlands but the areal extent and depth are not as promising as Class I areas. The deposits generally cover 20 to 200 square miles and contain enough peat to support a 60-megawatt steam electric plant. Class III areas may possibly contain sufficient quantities of fuel grade peat to supply the small technologies. These deposits generally occur in isolated patches of less than 20 square miles in size. Class III areas were not included in this study due to their lower probability of significant mining in the near future. A county was classified as Class I or II if approximately 5% or more of the county was covered by one of the regions. Class I areas were given priority over Class II if both occurred within a county. Often the reports contained comments that identified additional counties as containing important peat deposits; these counties were also included in the data set.

ORNL-DWG 81-10884 ESD

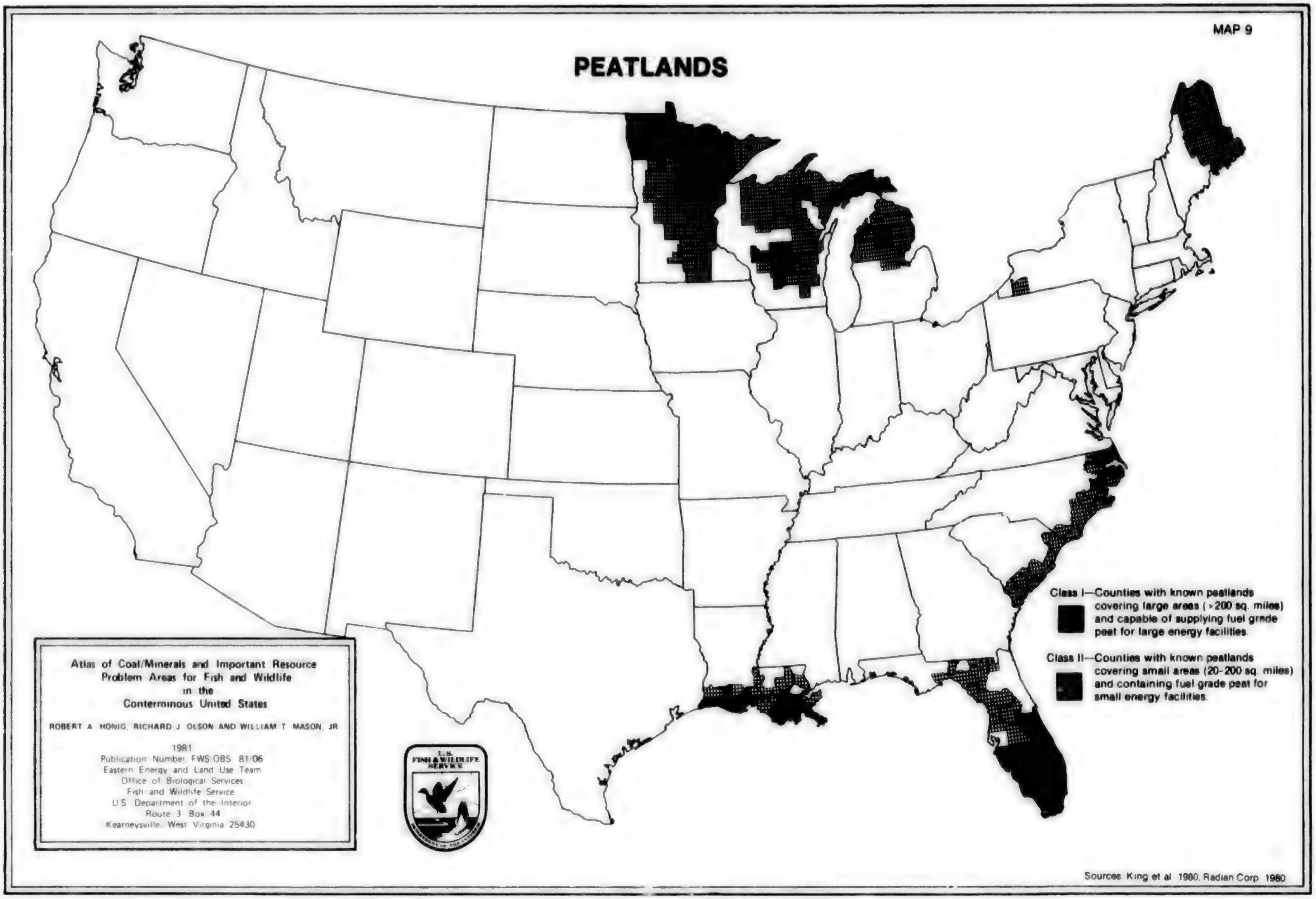

MAP 9
PEATLANDS
Class I—Counties with known peatlands covering large areas (>200 sq. miles) and capable of supplying fuel grade peat for large energy facilities.
Class II—Counties with known peatlands covering small areas (20-200 sq. miles) and containing fuel grade peat for small energy facilities.
Atlas of Coal/Minerals and Important Resource Problem Areas for Fish and Wildlife in the Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR
1981
Publication Number FWS/OBS-81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
U.S. FISH & WILDLIFE SERVICE
Sources: King et al. 1980, Radian Corp. 1980

Figure 12. Counties containing Class I and/or Class II peat resources.

Phosphate

Phosphorus, along with nitrogen and potassium, is an essential element for plant growth, but it tends to be less abundant than nitrogen and potassium, especially in heavily cropped or thoroughly leached soils. Thus it is not surprising that about 70% of domestic consumption of phosphate rock is in fertilizer production. The fertilizer industry will continue to be the major consumer since there is no substitute for phosphorus as a plant food. Phosphate is also used in animal feed supplements, detergents, electroplating and metal polishing, insecticides, medicines, and incendiary bombs (Brobst and Pratt 1973).

Most U.S. phosphate rock contains recoverable amounts of fluorine for use in water treatment and conversion into metal fluxes. Florida and western phosphate rock contain from 0.1 and 0.4 pounds of uranium per ton, and western deposits may also contain recoverable vanadium (USBOM 1976).

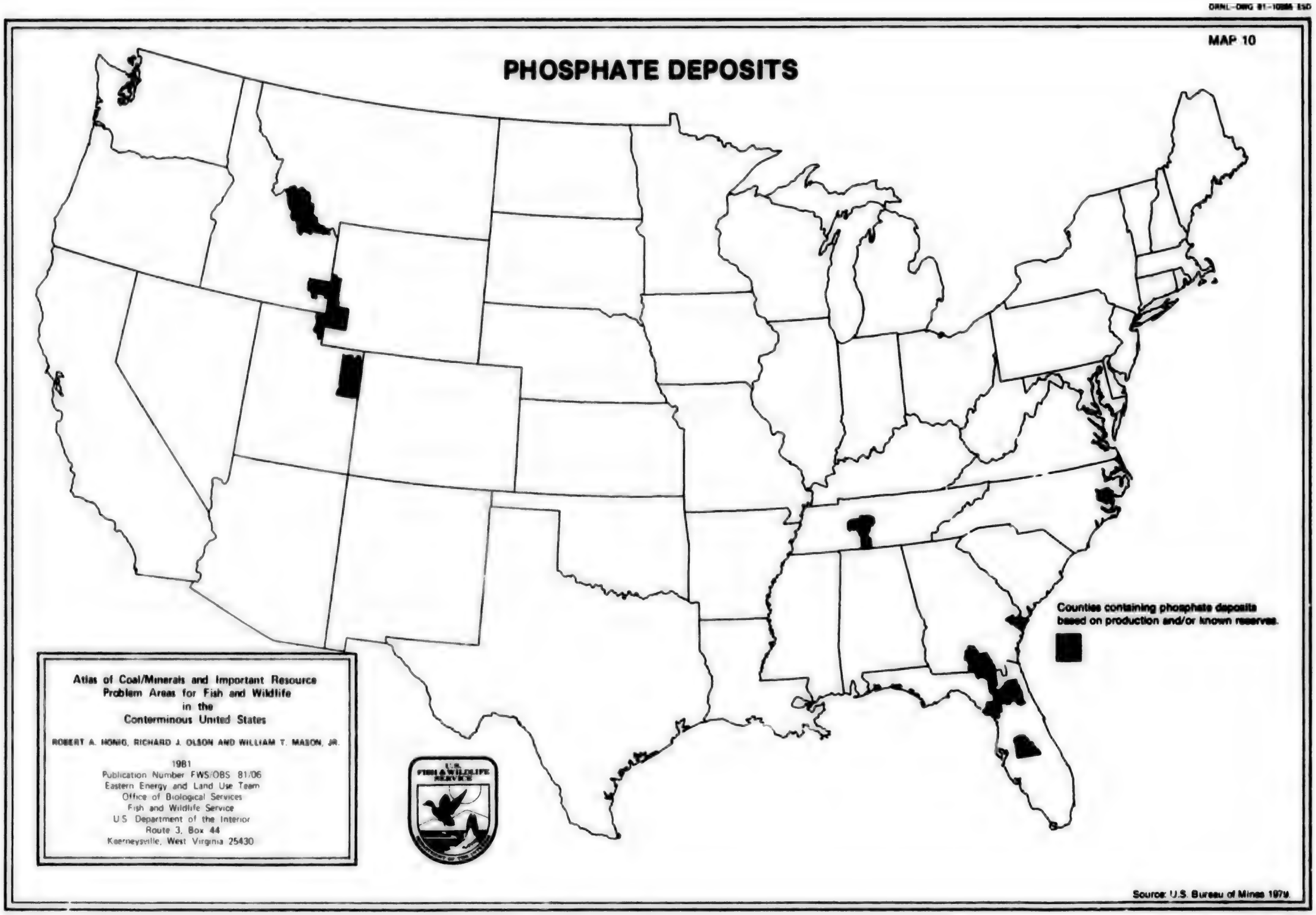
The total U.S. phosphate rock production in 1979 was approximately 50 million metric tons (approximately 55 million tons), 79% of which comes from Florida. North Carolina produces about 9% of U.S. phosphate rock, Tennessee 4%, and fields in Idaho, Alabama, Montana, and Utah contribute 8% of the total. The United States is a net exporter of phosphate rock (USBOM 1980).

Known recoverable U.S. phosphate rock reserves as of 1973 were estimated at 2.5 billion tons, with another 4.5 billion tons of identified resources that may become economically recoverable in the future. At current levels of production, the commercial deposits in Tennessee are expected to be depleted by 1990. Reserves in Idaho, Montana, Utah, and Wyoming are expected to continue production into the twenty-first century. The large reserves in Florida are capable of supporting maximum production levels until 1995 after which they will be depleted; those in North Carolina are expected to continue maximum production after that date (USBOM 1976).

Phosphate rock is strip mined except for two underground operations in Montana. In Florida and North Carolina the land must often be drained before mining, and the phosphate-bearing matrix is slurried in sluice pits and then pumped to a washing plant. Florida hard rock is not currently mined for phosphate (USBOM 1976).

Use of water in phosphate mine dewatering and processing has lowered the regional water table in Florida by as much as 40 feet, with some disruption of watercourses, destruction of wetlands, and deterioration of water quality. There is also a threat of contamination by radioactive elements associated with phosphate deposits. The waste clays, or slimes, from phosphate mining also pose a problem. Approximately two-thirds of the area mined for phosphate in central Florida since the 1940s has been covered by ponds containing slimes. Slimes cannot be economically reduced in volume and take decades to solidify. The best method for dewatering involves impounding the slimes above ground, but there is always a risk of dike failure. The slimes themselves, once stabilized, can be used only for farming, grazing, or light construction, as they are structurally weak at depth (NAS 1979).

Map 10 (Figure 13). Phosphate deposits were identified from the Bureau of Mines series of State Mineral Profiles (USBOM 1979). Deposits identified in these publications generally reflect past and current activity or deposits that have a high potential for future mining. The data recorded indicates the presence of a deposit and does not distinguish the current or future importance.


ORNL-DWG 81-10886 ESD
MAP 10
PHOSPHATE DEPOSITS
Counties containing phosphate deposits based on production and/or known reserves.
Atlas of Coal/Minerals and Important Resource
Problem Areas for Fish and Wildlife
in the
Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR.
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
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U.S. Department of the Interior
Route 3, Box 44
Kearneysville, West Virginia 25430
U.S. FISH & WILDLIFE SERVICE
Source: U.S. Bureau of Mines 1979

Figure 13. Counties containing phosphate deposits.

Sand and Gravel

Sand and gravel are geologically defined as unconsolidated mineral and rock particles that in most cases have been transported by water and abraded so that their edges are rounded or dulled (NAS 1980a). Sand is defined as material composed primarily of silica and within the size range of 0.0625 to 2 millimeters; sand is also used to describe fine particles of rocks, minerals, slag, and other materials. Gravel consists of naturally occurring rock particles in the size range of 4 to 64 millimeters in diameter. Granules, or "pea gravel," make up the size range from 2 to 4 millimeters (USBOM 1976).

Sand and gravel are important in virtually all construction, and the construction industry accounts for about 95% of all domestic consumption of sand and gravel (Brobst and Pratt 1973; FWS 1977a; NAS 1980a). Most is used in portland cement or asphaltic concrete, as general fill, and as a base under highways (NAS 1980a). Minor uses include railroad ballast and snow and ice control (USBOM 1980). The two components of the product also may be used separately. Of the two, sand has a wider range of uses, for example: in architectural structures; mortar; plaster; and all forms of road and pavement construction. Industrial grade sands are essential in glass manufacturing, foundry operations, chemical and metallurgical processers, and as abrasives. Byproducts and coproducts of sand and gravel production are almost nonexistent. Only small amounts of gold and silver are recovered (USBOM 1976).

Domestic sand and gravel production in 1974 was approximately one billion tons (USBOM 1976) and is the largest nonfuel mineral industry, in terms of volume, in the United States (Brobst and Pratt 1973). Because of the local availability of both sand and gravel, and the high costs of transportation, there results a fragmented industry with small installations located in and near populated areas (FWS 1977a). The five leading construction sand and gravel producing states in 1979 were California, Alaska, Texas, Ohio, and Michigan (USBOM 1980). The San Francisco Bay and Los Angeles areas accounted for 27 of the 100 largest operations in the United States as of 1970, and most of the remainder are east of the Mississippi River in the northern States (Brobst and Pratt 1973). The United States is a net exporter of sand and gravel (USBOM 1980).

The total sand and gravel resources of the United States are literally inexhaustible, however their geographic distribution and quality often preclude economic usefulness (USBOM 1976). By 2000, the economically recoverable resources may barely meet the demand. The most important sources of sand and gravel are river channels, flood plains, and glaciated terrain; however, as these become depleted, marine and lake environments could become important. A major problem currently facing the industry is land-use conflict: land with potentially valuable sand and gravel deposits is presently more valuable for building development and is thus removed from future mineral production. Development of low-cost transportation may be essential for the utilization of remote deposits (Brobst and Pratt 1973).

Sand and gravel are usually loose materials and thus are excavated without blasting (NAS 1980a). The two basic methods are dredging, for deposits that are below the water table, and open pit excavation (USBOM 1976). Thus, the environmental impacts include those typical of open pit methods such as noise, dust, and aesthetic effects. Excessive dust in some quarries can be a problem, especially if minerals such as asbestos are present. Dredging, which is widely practiced in major rivers such as the Mississippi, Missouri, and Ohio, causes increased sedimentation and can greatly alter aquatic habitats (NAS 1980a). Because of the virtual absence of sulfides and salts in sand and gravel deposits, water discharged from the mine sites contains no significant concentrations of dissolved heavy metals or other toxic constituents (NAS 1979). Beneficial effects of sand and gravel excavations include: creation of water bodies for storage or recreation; flood control; creation of migratory and cliff nesting bird habitat; and industrial or housing sites (NAS 1980a).

Zinc

Zinc is a ubiquitous minor element in the earth's crust and is a neccessity to modern living (Brobst and Pratt 1973). It was first called false silver about 2,000 years ago, undoubtedly due to its bluish-white color (USBOM 1976). Major uses of zinc in 1979 were in galvanizing of iron and steel products (40%), zinc-base alloy die castings (29%), brass and bronze (14%), zinc oxide (12%), and other uses (5%) including rolled zinc metal. Major industrial consumers of zinc in 1979 were the manufacture of construction materials (40%), transportation equipment (26%), electrical equipment (12%), and machinery and chemicals (10%). About one-half of the consumption was in Illinois, New York, Ohio, and Pennsylvania (USBOM 1980). Byproducts and coproducts of zinc include gold, silver, copper, lead, fluorspar, and manganese. In fact, many important zinc mines in the United States were initially lead or lead/silver mines. The host rocks in Tennessee, Virginia, and the Upper Mississippi Valley are limestone and dolomite, and large quantities of the tailings are sold as agricultural limestone or crushed stone (USBOM 1976).

The principal methods for mining zinc are room and pillar (excavating chambers in a gently sloping ore body and leaving pillars of rock to support the roof), shrinkage (successively mining flat or inclined cuts or slices progressing upward from a haulage level), cut and fill, and square pit. Except for a few mines in Canada, open pit and block caving methods have not been extensively used (USBOM 1976).

Zinc production in the United States in 1979 was approximately 260,000 metric tons (approximately 287,000 tons). Major producing states were Tennessee (31%), Missouri (23%), New Jersey (12%), and Idaho (12%) (USBOM 1980). Identified, economically extractable reserves of zinc in the United States amount to 30 million tons, with another 20 million tons which may become economically recoverable under future economic conditions. The largest demonstrated reserve is in the southeast Missouri lead district where zinc is a coproduct of lead; the next largest is in eastern and middle Tennessee. Other states with notable reserves are Maine, New Jersey, New York, Pennsylvania, Virginia, Illinois, Wisconsin, Idaho, Montana, Washington, Arizona, California, Colorado, New Mexico, and Utah (USBOM 1976; Barr Engineering Co. et al. 1980).

Silver

Silver, a critical element in our national economy, is a major industrial metal, the physical properties of which make it desirable for a variety of uses. It is extremely ductile and malleable, it has the highest electrical and thermal conductivity of all metals, its compounds are highly photosensitive, and it is stable in air and water except for tarnishing when exposed to sulfur compounds. Adequate, low-cost substitutes are very difficult to find (Brobst and Pratt 1973).

The largest single use of silver in 1979 was in the photographic industry which accounted for 39% of consumption (USBOM 1980). Photography is based almost entirely on light-sensitive silver halides derived from silver nitrates and related compounds which provide unsurpassed image clarity. Processes that do not require silver have been developed for black and white photography, but they are not adaptable to color films (USBOM 1976). Other major users of silver are: electrical and electronic components, 25%; sterlingware and electroplated silverware, 15%; and brazing alloys and solders, 8% (USBOM 1980). The remaining silver consumed includes the manufacture of jewelry, arts, and crafts, and use in medicines, dentistry, mirror backing, bearings, catalysts, coinage, and nuclear control rods (USBOM 1976).

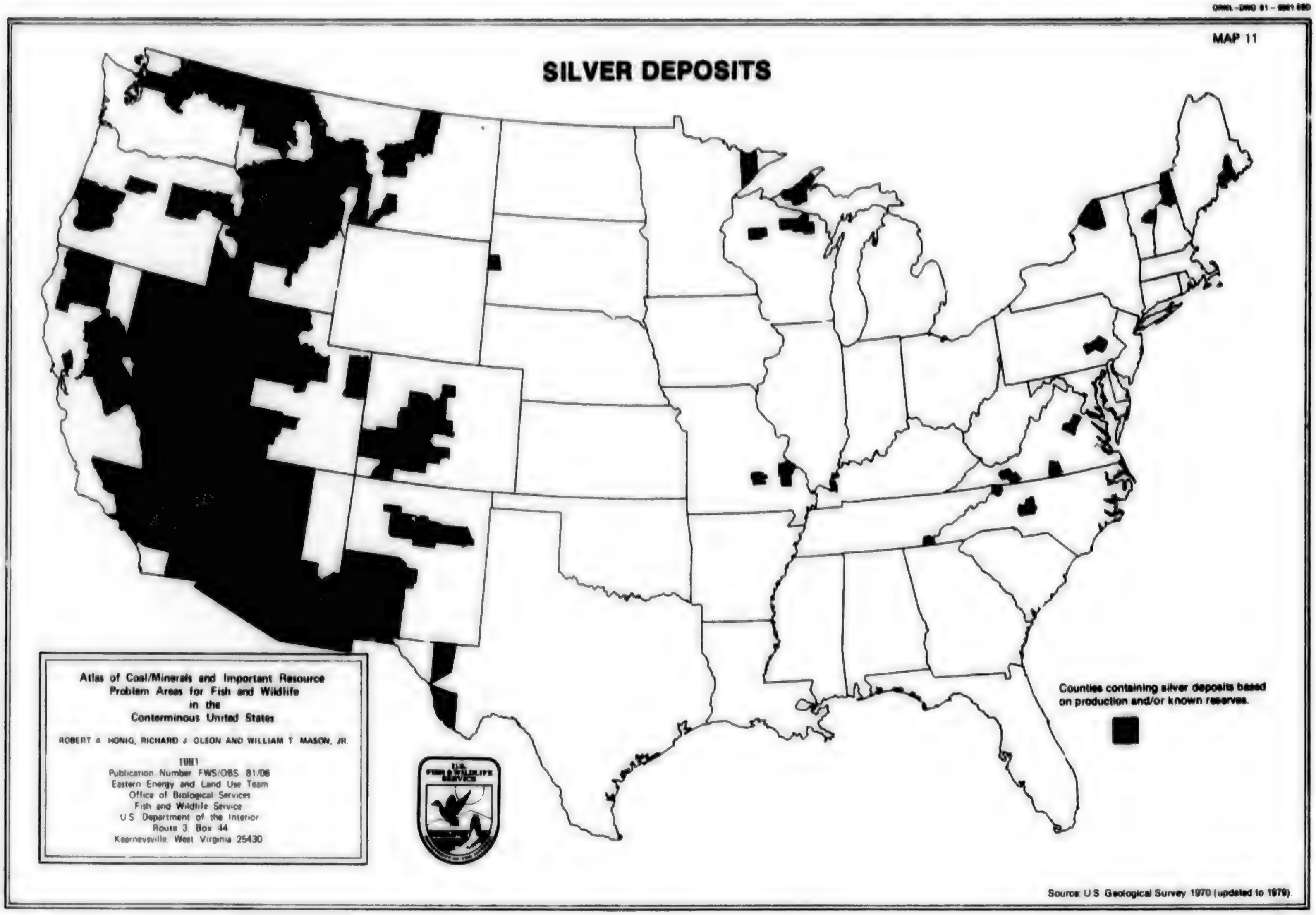
Due to its economic and industrial importance, and the general lack of adequate low-cost substitutes, the United States and the rest of the free world are confronted with the long-range problem of a serious imbalance between consumption and new production (Brobst and Pratt 1973). In 1979, estimated U.S. imports of silver amounted to 45% of consumption, and, as of 1973, a major worldwide imbalance of more than 100 million ounces of silver per year existed between production and consumption. The deficit between domestic production and consumption formerly was partly filled by releases from U.S. Treasury stocks, but these reserves are now depleted. This deficit must be made up from liquidation of private stocks, reclaimed silver, imports, increased new production, or use of substitutes for silver (Brobst and Pratt 1973).

Domestic silver production in 1979 was estimated at 38.3 million troy ounces. Major producing states were: Idaho, 48%; Arizona, 19%; Colorado, 8%; and Utah, Montana, and Missouri, 20% (USBOM 1980). Identified United States silver reserves are estimated to be 1.5 billion troy ounces. Geological evidence predicts another 4.2 billion ounces of other silver resources (USBOM 1976).

Depending on the characteristics of the deposit, silver is mined by open pit methods or subsurface shafts and drifts (USBOM 1976). Approximately 66% of primary silver production in the United States was a byproduct of copper, lead, and zinc mining (USBOM 1980). In fact, about two-thirds of the world's silver reserves and resources are a byproduct of copper, lead, zinc, and sulfide production, while veins in which silver is the main coproduct supply the remaining reserves and resources. Silver is also commonly found with gold, but this accounts for only 1% of domestic production. Within the United States, the only other important byproduct of silver mining is antimony, which is found in the Coeur d'Alene area in Idaho (USBOM 1976).

Map 11 (Figure 14). See section on Copper for discussion of the map data base.

Additional counties in Missouri containing silver deposits of concern to FWS but not shown on Map 11 are listed in Appendix C (R. Welford, FWS, Twin Cities, MN, pers. comm.).



ORNL-DWG 81-8881 ESD
MAP 11
SILVER DEPOSITS
Atlas of Coal/Minerals and Important Resource Problem Areas for Fish and Wildlife in the Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR.
FWS/OBS 81/06
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Route 3, Box 44
Kearneysville, West Virginia 25430
U.S. FISH & WILDLIFE SERVICE
Counties containing silver deposits based on production and/or known reserves.
Source: U.S. Geological Survey 1970 (updated to 1979)

Figure 14. Counties containing silver deposits.

Uranium

Uranium is a silvery-white metal that consists of three semistable radioactive isotopes -- U^{238}, U^{235}, U^{234}. The fission of U^{235} releases large amounts of energy making it a very important energy source for use in nuclear reactors. One pound of U_3O_8 (processed ore) produces the heat equivalent of about eight tons of coal (Brobst and Pratt 1973). Byproducts and coproducts of uranium include vanadium, molybdenum, copper, gold, rare earths, and yttrium. Uranium is also a byproduct of wet-process phosphoric acid in phosphatic fertilizer production in central Florida (USBOM 1976).

At the end of 1971, the identified recoverable resources in the United States totaled 273,000 tons of U_3O_8. Domestic hypothetical recoverable resources as of that date are estimated to total about 500,000 tons. Other resources were deemed not economically recoverable by 1972 technologies (Brobst and Pratt 1973). Most known United States uranium resources are located in the west, as are all operating mills and mills planned for operation by 1983. Through 1977 the western portion of the U.S. has accounted for 99% of U_3O_8 production, 100% of the reserves, and 93% of the potential resources. Production for meeting uranium needs by the year 2000 will be centered primarily in New Mexico and Wyoming, and to a lesser extent in Utah (Horak and Olson 1980).

In general, uranium mining involves conventional open pit or underground mining techniques (USBOM 1976). These processes are estimated to account for 87% of U_3O_8 production in the year 2000, while solution mining is expected to account for 5%. It is estimated that mining of uranium up to the year 2000 will have disturbed approximately 53,100 hectares (132,750 acres). When exploration, milling, and tailings are included, the estimated total land disturbed will be 828,000 hectares (2,070,000 acres). However, 92% of this total will be from exploration and is considered minor and temporary (Horak and Olson 1980).

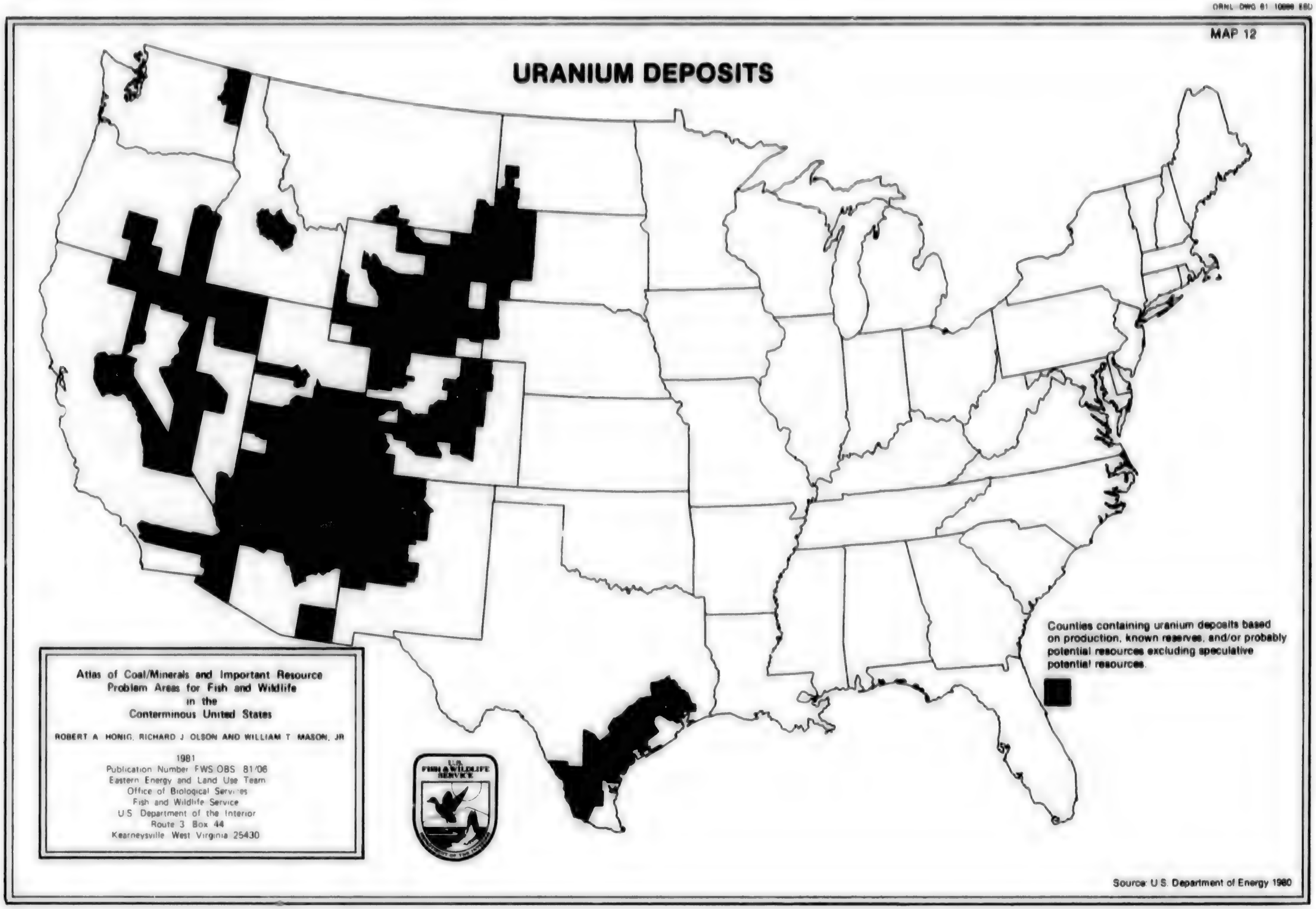
One of the breakdown products of U^{238} is Rn^{222}, a radioactive isotope of radon. Rn^{222} breaks down to metals which are easily deposited in the respiratory tract or otherwise absorbed by organisms. Radiation effects on the biota include mortality, chromosomal aberrations, and reduced fecundity. Ruminants are particularly susceptible to radioactive exposure from contaminated plants which can absorb radioactive substances via root systems or via atmospheric fallout. In addition selenium and vanadium from uranium mines can be accumulated by plants. Drinking water for wildlife may also contain elevated radioactivity (Horak and Olson 1980).

Precipitation on ore and waste rock piles and on exposed rock surfaces can produce runoff with leached uranium, radium, selenium, molybdenum, vanadium, increased acidity, and diverse salts (NAS 1979; Horak and Olson 1980).

In situ solution mining as practiced in several Texas and Wyoming operations (NAS 1979) should not directly affect aquatic resources as wastes are usually disposed of in bottom-sealed evaporation basins. However, aquatic resources potentially may be affected due to groundwater contamination via seeps and springs (Horak and Olson 1980). Radon in exhaust air from underground mines or wind-borne particulates from surface mines and waste piles may degrade air quality (NAS 1979). Dust may also contain radioactive uranium, thorium, and radium, and trace elements such as arsenic, lead, selenium, and vanadium. This may cause localized effects such as irritation of animal mucous membranes (Horak and Olson 1980).

Reclamation of lands in the west mined for uranium is hampered by low precipitation, high evaporation and transpiration, a short growing season, and poor soil. Uranium tailings are usually very fine and difficult to stabilize. Overburden or interburden spoils can be acidic making revegetation very difficult (NAS 1979).

Map 12 (Figure 15). Uranium resources were defined using the 1980 map compiled by the National Uranium Resource Evaluation (NURE) project (USDOE 1980, p. 15). The map shows locations of uranium deposits based on the reliability of the information. In this study, county occurrences of "probable and/or possible potential resources" were not included. Counties included contain either known reserves or potential resources. The potential resources include probable deposits (those occurring in known productive uranium areas) and possible deposits (those in which the formations or geological setting are favorable for uranium deposits) (USDOE 1980, p. 2). The resulting county-level map was compared against a map depicting productive uranium mines (SAI 1980c). There was generally good agreement except for some isolated occurrences and mines outside of the regions shown on the USDOE map.



ORNL DWG 81 10896 ESD
MAP 12
URANIUM DEPOSITS
Counties containing uranium deposits based on production, known reserves, and/or probably potential resources excluding speculative potential resources.
Atlas of Coal/Minerals and Important Resource
Problem Areas for Fish and Wildlife
in the
Conterminous United States
ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR
1981
Publication Number FWS/OBS 81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
Route 3 Box 44
Kearneysville West Virginia 25430
U.S. FISH & WILDLIFE SERVICE
Source: U.S. Department of Energy 1980

Figure 15. Counties containing uranium deposits.

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Appendix A

1980-81 U.S. FISH & WILDLIFE SERVICE IMPORTANT RESOURCE PROBLEMS (* IRP NOT INCLUDED IN THIS STUDY).

IRP		IRP_DESC
1		Steelhead Trout, Chinook & Sockeye Salmon - Columbia Basin
2		Endangered Species (several) - South Florida Wetlands & Keys
3		Endangered Rails and Tern - California Coastal Wetlands
4		Endangered Birds/Migratory Birds - Texas Gulf Coast
5		Migratory Waterfowl & Other Mig. Birds - Lower Miss. River
6		Migratory Waterfowl - N. Dakota, S. Dakota, Minn.
7		Migratory Waterfowl - Coastal Marshes Louisiana
8		Migratory Waterfowl - Central Valley California
9	*	Arctic & Am. Peregrine Falcon - N. Slope & Int. Alaska
10	*	Acid Rain Impacts - Nationwide
11		Freshwater Fishes & Fish Habitat - Great Lakes
12		Migratory Birds/Endangered Species - Nebraska
13		Endangered Fish - Upper and Lower Colo. River
14		Anadromous Fish (Striped Bass & Shad) - Chesapeake Bay
15	*	Migratory Birds - Lead Poisoning
16	*	Waterfowl Disease (Avian Cholera & DVE) - Nationwide
17		Steelhead Trout & Chinook Salmon - Sacramento/San Joaquin Basins
18		Salmon & Steelhead Trout - Klamath Basin, N. Coast Streams, CA, OR
19		Endangered Birds (Bald Eagle) - Lower 48 States
20	*	Endangered Birds - Hawaiian & Trust Territories
21		Migratory Birds - Rio Grande Valley
22		Anadromous Fishes (PCB/PCBF) - Hudson River
23		Endangered Kirtlands Warbler
24		Endangered & Other Species - Barrier Islands, East & Gulf Coast
25		Endangered Species, Western Coal Development Impacts - West
26		Anadromous Fish, Atlantic Salmon and Shad - New England
27		Migratory Waterfowl, Diving Ducks - Atlantic & Miss. Flyways
28		Migratory Birds - Lower Colorado River Basin, Arizona
29		Black Duck - Coastal Mid-Atlantic
30		Endangered California Condor - S. Calif. Moutains & Valley
31		Migratory Waterfowl & Marine Birds - Coastal Washington & Oregon
32		Migratory Waterfowl - Coastal Marshes, NC and SC
33	*	Bald Eagle - Southeastern Alaska incl. Chilkat River Valley
34		Migratory Waterfowl, Category 11 - Great Lakes
35		Migratory Waterfowl & other Migr. Birds - Klamath Basin of OR & CA
36		Black Duck - New England
37	*	Marine Mammals - North Slope & Western Alaska
38		Endangered Species (several) - Coastal GA, SC & NC
39		Pacific Salmon, Steelhead - Puget Sound
40	*	Pacific Salmon - Southeast & Southcentral Alaska
41	*	Anadromous/Resident Freshwater Fishes - Alaska Pen./Bristol Bay
42	*	Migratory Waterfowl - North Slope/Beaufort Sea, Alaska
43	*	Exotic Fish Impact - Nationwide
44		Endangered Species, Cool- & Coldwater Fish - Cumberland Plateau
45	*	Migratory Waterfowl - N.E. Gulf of Alaska
46	*	Migratory Waterfowl/Marine Birds - Alaska Peninsula/Bristol Bay
47	*	Migratory Waterfowl - Yukon Flats/Upper Yukon River Basin
48	*	Migr. Waterfowl/Marine Birds - Yukon/Kuskowim Delta, S. Bering Sea
49		Estuarine & Anadromous Fish - NC, SC, FL, GA, MS, AL, & LA
50		Endangered Species - Mid-Gulf Drainage
51		Anadromous Fish - Mid-Atlantic
52		Migratory Waterfowl - Sandhills Area Groundwater Recharge NE
53		Waterfowl & Other Waterbirds - Stillwater Basin Nevada
54		Endangered Fishes - Truckee River Basin Nevada
55		Bottomland Hardwood End. Species & Migratory Waterfowl - FL & GA
56		Migratory Waterfowl, Marinebirds & Other Mig. Birds - Coastal CA
57		Migratory Waterfowl Habitat Losses - Rio Grande, Pecos Basins, NM
58		Waterfowl/Other Water Birds - Harney Basin, Oregon
59		Migratory Waterfowl - Playa Lakes
60		Endangered Fishes - Isolated Springs, AZ, TX, and NM
61		Migratory Waterfowl - Great Lakes Coastal Marshes, MI and OH
62	*	Marine Mammals - Southeast/Northern Gulf of Alaska
63		Migratory Birds - Yellowstone Basin
64	*	Porcupine Caribou Herd/Arctic Grizzly - North Slope AK
65		Endangered Mollusks and Finfish - Tennessee River Basin, VA
66		Endangered Mollusks - Upper Mississippi River
67		Golden Eagle - West Texas
68		Migratory Shorebird Staging Areas - Eastern Maine
69		Migratory Birds - Flathead River Basin
70		Prairie River Migratory Birds - James River, ND and SD
71		Greater Sandhill Crane - Indiana
72		Other Mig. Birds/Herons, Egrets, Gulls & Terns - Upper Miss. R.
73		Other Birds/Gulls, Terns, Herons & Egrets - Great Lakes
74	*	End. Species: Mammals, Birds, Herptiles - Puerto Rico, Virgin I.
75		Wintering Waterfowl, Shore & Wading Birds - Salton Sea
76		American Woodcock Population Decline - Northeast
77		Woodduck Nesting Habitat
78	*	International Fish & Wildlife Habitat Conservation & Research

Appendix B

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                 1980-81 U.S. FISH & WILDLIFE SERVICE  IMPORTANT RESOURCE PROBLEMS BY MAJOR ANIMAL CONCERN.

-------------------------------------------------- TYPE=AMPHIBIANS & REPTILES --------------------------------------------------

                 IRP     IRP_DESC

                  2      Endangered Species (several) - South Florida Wetlands & Keys
                 24      Endangered & Other Species - Barrier Islands, East & Gulf Coast
                 38      Endangered Species (several) - Coastal GA, SC & NC
                 50      Endangered Species - Mid-Gulf Drainage
                 55      Bottomland Hardwood End. Species & Migratory Waterfowl - FL & GA

------------------------------------------------------------ TYPE=BIRDS ------------------------------------------------------------

                 IRP     IRP_DESC

                  2      Endangered Species (several) - South Florida Wetlands & Keys
                  3      Endangered Rails and Tern - California Coastal Wetlands
                  4      Endangered Birds/Migratory Birds - Texas Gulf Coast
                  5      Migratory Waterfowl & Other Mig. Birds - Lower Miss. River
                  6      Migratory Waterfowl - N. Dakota, S. Dakota, Minn.
                  7      Migratory Waterfowl - Coastal Marshes Louisiana
                  8      Migratory Waterfowl - Central Valley California
                 12      Migratory Birds/Endangered Species - Nebraska
                 19      Endangered Birds (Bald Eagle) - Lower 48 States
                 21      Migratory Birds - Rio Grande Valley
                 23      Endangered Kirtlands Warbler
                 24      Endangered & Other Species - Barrier Islands, East & Gulf Coast
                 25      Endangered Species, Western Coal Development Impacts - West
                 27      Migratory Waterfowl, Diving Ducks - Atlantic & Miss. Flyways
                 28      Migratory Birds - Lower Colorado River Basin, Arizona
                 29      Black Duck - Coastal Mid-Atlantic
                 30      Endangered California Condor - S. Calif. Mountains & Valley
                 31      Migratory Waterfowl & Marine Birds - Coastal Washington & Oregon
                 32      Migratory Waterfowl - Coastal Marshes, NC and SC
                 34      Migratory Waterfowl, Category 11 - Great Lakes
                 35      Migratory Waterfowl & other Migr. Birds - Klamath Basin of OR & CA
                 36      Black Duck - New England
                 38      Endangered Species (several) - Coastal GA, SC & NC
                 44      Endangered Species, Cool- & Coldwater Fish - Cumberland Plateau
                 50      Endangered Species - Mid-Gulf Drainage
                 52      Migratory Waterfowl - Sandhills Area Groundwater Recharge NE
                 53      Waterfowl & Other Waterbirds - Stillwater Basin Nevada
                 55      Bottomland Hardwood End. Species & Migratory Waterfowl - FL & GA
                 56      Migratory Waterfowl, Marinebirds & Other Mig. Birds - Coastal CA
                 57      Migratory Waterfowl Habitat Losses - Rio Grande, Pecos Basins, NM
                 58      Waterfowl/Other Water Birds - Harney Basin, Oregon
                 59      Migratory Waterfowl - Playa Lakes
                 61      Migratory Waterfowl - Great Lakes Coastal Marshes, MI and OH
                 63      Migratory Birds - Yellowstone Basin
                 67      Golden Eagle - West Texas
                 68      Migratory Shorebird Staging Areas - Eastern Maine
                 69      Migratory Birds - Flathead River Basin
                 70      Prairie River Migratory Birds - James River, ND and SD
                 71      Greater Sandhill Crane - Indiana
                 72      Other Mig. Birds/Herons, Egrets, Gulls & Terns - Upper Miss. R.
                 73      Other Birds/Gulls, Terns, Herons & Egrets - Great Lakes
                 75      Wintering Waterfowl, Shore & Wading Birds - Salton Sea
                 76      American Woodcock Population Decline - Northeast
                 77      Woodduck Nesting Habitat

------------------------------------------------------------ TYPE=FISHES ------------------------------------------------------------

                 IRP     IRP_DESC

                  1      Steelhead Trout, Chinook & Sockeye Salmon - Columbia Basin
                 11      Freshwater Fishes & Fish Habitat - Great Lakes
                 12      Migratory Birds/Endangered Species - Nebraska
                 13      Endangered Fish - Upper and Lower Colo. River
                 14      Anadromous Fish (Striped Bass & Shad) - Chesapeake Bay
                 17      Steelhead Trout & Chinook Salmon - Sacramento/San Joaquin Basins
                 18      Salmon & Steelhead Trout - Klamath Basin, N. Coast Streams, CA, OR
                 22      Anadromous Fishes (PCB/PCBP) - Hudson River
                 24      Endangered & Other Species - Barrier Islands, East & Gulf Coast
                 25      Endangered Species, Western Coal Development Impacts - West
                 26      Anadromous Fish, Atlantic Salmon and Shad - New England
                 39      Pacific Salmon, Steelhead - Puget Sound
                 44      Endangered Species, Cool- & Coldwater Fish - Cumberland Plateau
                 49      Estuarine & Anadromous Fish - NC, SC, FL, GA, MS, AL, & LA
                 50      Endangered Species - Mid-Gulf Drainage
                 51      Anadromous Fish - Mid-Atlantic
                 54      Endangered Fishes - Truckee River Basin Nevada
                 55      Bottomland Hardwood End. Species & Migratory Waterfowl - FL & GA
                 60      Endangered Fishes - Isolated Springs, AZ, TX, and NM
                 65      Endangered Mollusks and Finfish - Tennessee River Basin, VA
                 69      Migratory Birds - Flathead River Basin

-------------------------------------------------------- TYPE=INVERTEBRATES --------------------------------------------------------

                 IRP     IRP_DESC

                 24      Endangered & Other Species - Barrier Islands, East & Gulf Coast
                 44      Endangered Species, Cool- & Coldwater Fish - Cumberland Plateau
                 50      Endangered Species - Mid-Gulf Drainage
                 65      Endangered Mollusks and Finfish - Tennessee River Basin, VA
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                APPENDIX B. 1980-81 U.S. FISH & WILDLIFE SERVICE  IMPORTANT RESOURCE PROBLEMS BY MAJOR ANIMAL CONCERN.
-------------------------------------------------------- TYPE=INVERTEBRATES - ------------------------------------------------------

                          IRP     IRP_DESC

                          66      Endangered Mollusks - Upper Mississippi River

----------------------------------------------------------- TYPE=MAMMALS -----------------------------------------------------------

                          IRP     IRP_DESC

                           2      Endangered Species (several) - South Florida Wetlands & Keys
                          24      Endangered & Other Species - Barrier Islands, East & Gulf Coast
                          25      Endangered Species, Western Coal Development Impacts - West
                          38      Endangered Species (several) - Coastal GA, SC & NC
                          44      Endangered Species, Cool- & Coldwater Fish - Cumberland Plateau
                          50      Endangered Species - Mid-Gulf Drainage
                          55      Bottomland Hardwood End. Species & Migratory Waterfowl - FL & GA
                          69      Migratory Birds - Flathead River Basin
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Appendix C

Counties in the conterminous United States and associated IRPs and minerals. "X" indicates the presence of a mineral deposit based on the primary data source(s) for a given map; "*" indicates other deposits of concern to FWS.

Minerals: COAL (1 = <1,000 tons, 2 = 1,000-100,000 tons, 3 = >100,000 tons); CU = copper; G_T = geothermal resources (1 = >150°C, 2 = 90-150°C, 3 = <90°C); AU = gold; FE = iron; MO = molybdenum; NI = nickel; O_S = oil shale/tar sands (1 = oil shale, 2 = tar sands, 3 = both); PEAT (1 = Class I resource, 2 = Class II resource); P = phosphate; AG = silver; U = uranium.

FIPS STATE NUMBER and FIPS_CO are Federal Information Processing Standards state and county code numbers, respectively.

-- FIPS STATE NUMBER=01 STATE=ALABAMA --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	AUTAUGA	49													001
003	BALDWIN	24 49 50													003
005	BARBOUR	49	2												005
007	BIBB		*				X			1					007
009	BLOUNT		1							1					009
011	BULLOCK	49													011
013	BUTLER		*												013
015	CALHOUN														015
017	CHAMBERS														017
019	CHEROKEE		*												019
021	CHILTON	49													021
023	CHOCTAW	49	2												023
025	CLARKE	49	*												025
027	CLAY			X			X	X							027
029	CLEBURNE			X		X									029
031	COFFEE	49	2												031
033	COLBERT	44								2					033
035	CONECUH	49	*												035
037	COOSA	49													037
039	COVINGTON	49													039
041	CRENSHAW	49	2												041
043	CULLMAN		2							2					043
045	DALE	49	1												045
047	DALLAS	49													047
049	DE KALB	44 65	1							1					049
051	ELMORE	49													051
053	ESCAMBIA	49													053
055	ETOWAH		*							1					055
057	FAYETTE		2												057
059	FRANKLIN	44	*				X			2					059
061	GENEVA	49													061
063	GREENE	49													063
065	HALE														065
067	HENRY		*												067
069	HOUSTON														069
071	JACKSON	44 65	2				X			1					071
073	JEFFERSON		2				X			1					073
075	LAMAR		*												075
077	LAUDERDALE	44 65								1					077
079	LAWRENCE	44	*							2					079
081	LEE														081
083	LIMESTONE	44								1					083
085	LOWNDES	49													085
087	MACON	49													087
089	MADISON	44	*							1					089
091	MARENGO	49	2												091
093	MARION		2												093
095	MARSHALL	44	*				X			1					095
097	MOBILE	24 49 50													097
099	MONROE	49	*												099
101	MONTGOMERY	49													101
103	MORGAN	44	*							2					103
105	PERRY														105
107	PICKENS														107
109	PIKE	49	2												109
111	RANDOLPH														111
113	RUSSELL														113
115	ST CLAIR	49	1							1					115
117	SHELBY	49	1												117
119	SUMTER	49	1												119
121	TALLADEGA	49					X								121
123	TALLAPOOSA	49				X									123
125	TUSCALOOSA		2												125
127	WALKER		2												127
129	WASHINGTON	49													129
131	WILCOX	49	2												131
133	WINSTON		1												133

-- FIPS STATE NUMBER=04 STATE=ARIZONA --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	APACHE	13 25 28	2		3									X	001
003	COCHISE	13 60		X	2	X		X					X	X	003
005	COCONINO	13 28	2	X				X					X	X	005
007	GILA	13 28		X	3	X	X	X					X	X	007
009	GRAHAM	13 28 60		X	2			X					X		009

APPENDIX C (CONTINUED)

FIPS STATE NUMBER=04 STATE=ARIZONA

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
011	GREENLEE	13 28		X	2	X		X					X		011
013	MARICOPA	13 28		X	1	X	X						X		013
015	MOHAVE	13 28		X	1	X		X					X	X	015
017	NAVAJO	13 25 28	2				X	X						X	017
019	PIMA	13 60		X	3	X		X					X		019
021	PINAL	13 28		X	3	X	X	X					X		021
023	SANTA CRUZ	13 60		X		X		X					X		023
025	YAVAPAI	13 28		X	3	X	X	X					X	X	025
027	YUMA	13 28		X	3	X	X						X	X	027

FIPS STATE NUMBER=05 STATE=ARKANSAS

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
001	ARKANSAS	5	*												001
003	ASHLEY	5	*												003
005	BAXTER														005
007	BENTON									1					007
009	BOONE									1					009
011	BRADLEY	5	1												011
013	CALHOUN	5	1												013
015	CARROLL									1					015
017	CHICOT	5 49	*												017
019	CLARK	5	1												019
021	CLAY	5	*												021
023	CLEBURNE														023
025	CLEVELAND	5	1				X								025
027	COLUMBIA	5	*												027
029	CONWAY														029
031	CRAIGHEAD	5	*												031
033	CRAWFORD		2												033
035	CRITTENDEN	5	*												035
037	CROSS	5	*												037
039	DALLAS	5	1												039
041	DESHA	5 49	*												041
043	DREW	5	*												043
045	FAULKNER	5													045
047	FRANKLIN		2												047
049	FULTON														049
051	GARLAND	5								1					051
053	GRANT	5	1												053
055	GREENE	5	1												055
057	HEMPSTEAD	5	*												057
059	HOT SPRING	5	1				X			1					059
061	HOWARD	5													061
063	INDEPENDENCE	5	*							1					063
065	IZARD														065
067	JACKSON	5	*												067
069	JEFFERSON	5	*												069
071	JOHNSON		2												071
073	LAFAYETTE		*												073
075	LAWRENCE	5	*												075
077	LEE	5	*												077
079	LINCOLN	5	*												079
081	LITTLE RIVER	5													081
083	LOGAN		2												083
085	LONOKE	5	*												085
087	MADISON									1					087
089	MARION														089
091	MILLER		*												091
093	MISSISSIPPI	5	*												093
095	MONROE	5	*												095
097	MONTGOMERY	5								1					097
099	NEVADA	5	1												099
101	NEWTON									1					101
103	OUACHITA	5	1												103
105	PERRY														105
107	PHILLIPS	5	*												107
109	PIKE	5													109
111	POINSETT	5	1												111
113	POLK									1					113
115	POPE		2												115
117	PRAIRIE	5	*												117
119	PULASKI	5	2												119
121	RANDOLPH		*												121
123	ST FRANCIS	5	*												123
125	SALINE	5	1							1					125
127	SCOTT		2												127
129	SEARCY									1					129

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=05   STATE=ARKANSAS --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
131	SEBASTIAN		2												131
133	SEVIER	5													133
135	SHARP														135
137	STONE									1					137
139	UNION	5	*												139
141	VAN BUREN														141
143	WASHINGTON									1					143
145	WHITE	5	*												145
147	WOODRUFF	5	*												147
149	YELL														149

-- FIPS STATE NUMBER=06   STATE=CALIFORNIA --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ALAMEDA	3													001
		8													
		17													
		56													
003	ALPINE	17			2								X	X	003
005	AMADOR	17		X		X							X	X	005
007	BUTTE	8				X							X		007
		17													
009	CALAVERAS	17		X		X							X	X	009
011	COLUSA	8			2										011
		17													
013	CONTRA COSTA	3													013
		8													
		17													
015	DEL NORTE	18				X			X						015
		56													
017	EL DORADO	17				X							X	X	017
019	FRESNO	8		X		X									019
		30													
021	GLENN	8													021
		17													
023	HUMBOLDT	18				X									023
		56													
025	IMPERIAL	28			1	X							X		025
		75													
027	INYO	30		X	1	X		X					X	X	027
029	KERN	8			2	X				2			X		029
		30													
031	KINGS	8													031
		30													
033	LAKE				1										033
035	LASSEN	17			2	X									035
037	LOS ANGELES	3				X	X						X		037
		30													
		56													
039	MADERA	8					X								039
		17													
		30													
041	MARIN	3													041
		17													
		56													
043	MARIPOSA	17				X							X		043
		30													
045	MENDOCINO	56							X	2					045
047	MERCED	8				X									047
		17													
		30													
049	MODOC	18			1	X								X	049
		35													
051	MONO				1	X							X	X	051
053	MONTEREY	3													053
		30													
		56													
055	NAPA	3			2	X							X		055
057	NEVADA	17				X							X		057
		56													
059	ORANGE	3											X		059
		56													
061	PLACER	8		X		X							X		061
		17													
		56													
063	PLUMAS	17		X	1	X							X		063
065	RIVERSIDE	28			2	X	X						X	X	065
		75													
067	SACRAMENTO	3				X							X		067
		8													
		17													
069	SAN BENITO	30				X									069
071	SAN BERNADINO	28			1	X	X						X		071
073	SAN DIEGO	3			3	X			X						073
		56													
		75													
075	SAN FRANCISCO	3													075
		17													
		56													
077	SAN JOAQUIN	8				X									077

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                                                APPENDIX C (CONTINUED)
------------------------------------------ FIPS STATE NUMBER=06   STATE=CALIFORNIA ------------------------------------------

FIPS_CC     COUNTY               IMP  COAL    CU    G_T   AU    FE    MO    NI    O_S   PEAT   P   AG   U    FIPS_CC

                                 17
079         SAN LUIS OBISPO       3                 3                             2                          079
                                 30
                                 56
081         SAN MATEO             3                                               2                          081
                                 56
083         SANTA BARBARA         3                                               2                          083
                                 30
                                 56
085         SANTA CLARA           8                                               2                          085
                                 30
                                 56
087         SANTA CRUZ            3                                               2                          087
                                 30
                                 56
089         SHASTA                8           X     2     X     X                                  X         089
                                 17
                                 18
091         SIERRA               17                 2     X                                        X         091
                                 58
093         SISKIYOU             18           X           X                                        X         093
                                 35
095         SOLANO                3                                                                          095
                                  8
                                 17
097         SONOMA                3                 2                                                        097
                                 17
                                 56
099         STANISLAUS            8                       X                                                  099
                                 17
101         SUTTER                8                                                                          101
                                 17
103         TEHAMA                8                 1                                                        103
                                 17
                                 18
105         TRINITY              18           X           X                                        X         105
107         TULARE                8                       X                                                  107
                                 30
109         TUOLUMNE             17                       X                                        X    X    109
111         VENTURA               3                 2                                                        111
                                 30
                                 56
113         YOLO                  8                                                                          113
                                 17
115         YUBA                  8                       X                                        X         115
                                 17

------------------------------------------ FIPS STATE NUMBER=08   STATE=COLORADO ------------------------------------------

FIPS_CC     COUNTY               IMP  COAL    CU    G_T   AU    FE    MO    NI    O_S   PEAT   P   AG   U    FIPS_CC

001         ADAMS                25    2                  X                                             X    001
003         ALAMOSA                                 2                                                        003
005         ARAPAHOE             25    2                                                                X    005
007         ARCHULETA            13    2            3                                                        007
                                 25
009         BACA                 59                                                                          009
011         BENT                 59                                                                          011
013         BOULDER              25    2                  X     X     X                            X    X    013
015         CHAFFEE                           X     2     X     X     X                            X    X    015
017         CHEYENNE             59                                                                          017
019         CLEAR CREEK          25           X           X     X     X                            X         019
021         CONEJOS              25                 3                                                        021
023         COSTILLA             25                 3           X                                            023
025         CROWLEY              25                                                                          025
                                 59
027         CUSTER               25                       X     X                                  X         027
029         DELTA                13    2                        X                 1                          029
                                 25
031         DENVER               25                                                                          031
033         DOLORES              13           X     1     X     X                                  X    X    033
                                 25
035         DOUGLAS              25    1                                                                X    035
037         EAGLE                13           X           X     X                                  X         037
                                 25
039         ELBERT               25    2                                                                X    039
041         EL PASO              25    2                        X                                       X    041
043         FREMONT              25    2            3           X                                       X    043
045         GARFIELD             13    2            3                             1                          045
                                 25
047         GILPIN               25           X           X           X                            X         047
049         GRAND                13                                                                          049
                                 25
051         GUNNISON             13    2      X     2     X     X     X                            X    X    051
                                 25
053         HINSDALE             13           X                                                    X         053
                                 25
055         HUERFANO             25    2                                                                     055
057         JACKSON              13    2                              X                                      057
                                 25
059         JEFFERSON            25    2                  X           X                                 X    059
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APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=08 STATE=COLORADO ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
061	KIOWA	59													061
063	KIT CARSON	59													063
065	LAKE	25		X		X		X					X		065
067	LA PLATA	13 25	2	X	3	X							X	X	067
069	LARIMER	25						X							069
071	LAS ANIMAS	25 59	2												071
073	LINCOLN	25													073
075	LOGAN														075
077	MESA	13 25	2							1				X	077
079	MINERAL	13 25			2	X		X					X		079
081	MOFFAT	13 25	3				X			1				X	081
083	MONTEZUMA	13 25	2											X	083
085	MONTROSE	13 25	2	X									X	X	085
087	MORGAN	25												X	087
089	OTERO	25 59													089
091	OURAY	13 25	2	X		X	X	X					X		091
093	PARK	25	2			X		X					X	X	093
095	PHILLIPS														095
097	PITKIN	13 25	2		2	X		X					X		097
099	PROWERS	59													099
101	PUEBLO	25					X							X	101
103	RIO BLANCO	13 25	3							1				X	103
105	RIO GRANDE			X	3	X							X		105
107	ROUTT	13 25	3		2	X		X							107
109	SAGUACHE	25		X	2	X	X						X	X	109
111	SAN JUAN	13 25		X		X							X		111
113	SAN MIGUEL	13 25		X		X	X						X	X	113
115	SEDGWICK														115
117	SUMMIT	13 25				X	X	X					X		117
119	TELLER	25				X							X	X	119
121	WASHINGTON														121
123	WELD	25	2											X	123
125	YUMA														125

--- FIPS STATE NUMBER=09 STATE=CONNECTICUT ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	FAIRFIELD	22 36													001
003	HARTFORD	22 26 36		X				X							003
005	LITCHFIELD	22 36							X						005
007	MIDDLESEX	22 26 36							X						007
009	NEW HAVEN	22 36													009
011	NEW LONDON	24 26 36													011
013	TOLLAND	26 36													013
015	WINDHAM	36													015

--- FIPS STATE NUMBER=10 STATE=DELAWARE ---

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	KENT	19 51													001
003	NEW CASTLE	19 27 51													003
005	SUSSEX	19 28 51													005

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=11 STATE=WASH., D. C. ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	AG	U	FIPS_CO
001	WASHINGTON	14 19 76												001

--- FIPS STATE NUMBER=12 STATE=FLORIDA ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
001	ALACHUA											X			001
003	BAKER	55									2				003
005	BAY	24 49 50													005
007	BRADFORD											X			007
009	BREVARD	2 24 49									1				009
011	BROWARD	2 24 49									1				011
013	CALHOUN	49 50 55													013
015	CHARLOTTE	2 24 49									1				015
017	CITRUS	2 49									2				017
019	CLAY	2 49										X			019
021	COLLIER	2 49									1				021
023	COLUMBIA	49 55									2	X			023
025	DADE	2 24 49									1				025
027	DE SOTO	2 49									1				027
029	DIXIE	2 49									2				029
031	DUVAL	2 24 49													031
033	ESCAMBIA	24 49 50													033
035	FLAGLER	2 24 49													035
037	FRANKLIN	24 49 50 55													037
039	GADSDEN	49 55													039
041	GILCHRIST	49									2				041
043	GLADES	2									1				043
045	GULF	24 49 50													045
047	HAMILTON	49 55									2	X			047
049	HARDEE	2 49									1				049
051	HENDRY	2									1				051
053	HERNANDO	2 49									2				053
055	HIGHLANDS	2									1				055
057	HILLSBOROUGH	2 49													057
059	HOLMES	49													059
061	INDIAN RIVER	2 24 49									1				061
063	JACKSON	49 55													063
065	JEFFERSON	49 50									2				065
067	LAFAYETTE	49 55									2				067
069	LAKE	2 49									2				069
071	LEE	2 24 49									1				071
073	LEON	49 50													073
075	LEVY	2 49									2	X			075
077	LIBERTY	49													077

APPENDIX C (CONTINUED)

---------- FIPS STATE NUMBER=12 STATE=FLORIDA ----------

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		50 55													
079	MADISON	49 55													079
081	MANATEE	2 24 49									1				081
083	MARION	2									2				083
085	MARTIN	2 24 49									1				085
087	MONROE	2 24 49									1				087
089	NASSAU	24 49													089
091	OKALOOSA	24 49 50													091
093	OKEECHOBEE	2									1				093
095	ORANGE	2 49									1				095
097	OSCEOLA	2									1				097
099	PALM BEACH	2 24 49									1				099
101	PASCO	2 24 49									2				101
103	PINELLAS	2 24 49													103
105	POLK	2									2	X			105
107	PUTNAM	2 49										X			107
109	ST JOHNS	2 24 49													109
111	ST LUCIE	2 24 49									1				111
113	SANTA ROSA	24 49 50													113
115	SARASOTA	2 24 49									1				115
117	SEMINOLE	2 49													117
119	SUMTER	2									2				119
121	SUWANNEE	49 55									2				121
123	TAYLOR	49 50 55									2				123
125	UNION														125
127	VOLUSIA	2 24 49													127
129	WAKULLA	24 49 50									2				129
131	WALTON	24 49 50													131
133	WASHINGTON	49 50													133

---------- FIPS STATE NUMBER=13 STATE=GEORGIA ----------

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	APPLING	49 55			1										001
003	ATKINSON														003
005	BACON	55													005
007	BAKER	49													007
009	BALDWIN														009
011	BANKS														011
013	BARROW														013
015	BARTOW						X								015
017	BEN HILL														017
019	BERRIEN											X			019
021	BIBB														021
023	BLECKLEY														023
025	BRANTLEY	49 55			1										025
027	BROOKS														027
029	BRYAN	24 38 49			1							X			029

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                                             APPENDIX C (CONTINUED)
-------------------------------------- FIPS STATE NUMBER=13   STATE=GEORGIA --------------------------------------
FIPS_CO  COUNTY            IMP  COAL  CU  G_T  AU  FE  MO  NI  O_S  PEAT  P  AG  U  FIPS_CO
                            55
  031    BULLOCH            49             1                                          031
  033    BURKE              55                                                        033
  035    BUTTS                                                                        035
  037    CALHOUN                                                                      037
  039    CAMDEN             24                                                        039
                            38
                            49
                            55
  043    CANDLER            55             1                                          043
  045    CARROLL                                                                      045
  047    CATOOSA            44                                  1                     047
                            65
  049    CHARLTON           49                                                        049
                            55
  051    CHATHAM            24                                            X           051
                            38
                            49
                            55
  053    CHATTAHOOCHEE                                                                053
  055    CHATTOOGA          65   *                              1                     055
  057    CHEROKEE                              X                                      057
  059    CLARKE                                                                       059
  061    CLAY                                                                         061
  063    CLAYTON                                                                      063
  065    CLINCH             49                                            X           065
                            55
  067    COBB                                                                         067
  069    COFFEE             55                                                        069
  071    COLQUITT                                                                     071
  073    COLUMBIA                                                                     073
  075    COOK                                                             X           075
  077    COWETA                                                                       077
  079    CRAWFORD                                                                     079
  081    CRISP                                                                        081
  083    DADE               44   1                              1                     083
                            65
  085    DAWSON                                                                       085
  087    DECATUR            49                                                        087
  089    DE KALB                                                                      089
  091    DODGE                                                                        091
  093    DOOLY                                                                        093
  095    DOUGHERTY          49                                                        095
  097    DOUGLAS                                                                      097
  099    EARLY                                                                        099
  101    ECHOLS             49                                            X           101
                            55
  103    EFFINGHAM          49                                                        103
                            55
  105    ELBERT                                                                       105
  107    EMANUEL            55             1                                          107
  109    EVANS              55             1                                          109
  111    FANNIN             65        X                                               111
  113    FAYETTE                                                                      113
  115    FLOYD              65                                  1                     115
  117    FORSYTH                                                                      117
  119    FRANKLIN                                                                     119
  121    FULTON                                                                       121
  123    GILMER             65                                                        123
  125    GLASCOCK                                                                     125
  127    GLYNN              24             1                                          127
                            38
                            49
                            55
  129    GORDON             65                                  1                     129
  131    GRADY              49                                                        131
  133    GREENE                                                                       133
  135    GWINNETT                                                                     135
  137    HABERSHAM                                                                    137
  139    HALL                                                                         139
  141    HANCOCK                                                                      141
  143    HARALSON                     X                                               143
  145    HARRIS                                                                       145
  147    HART                                                                         147
  149    HEARD                                                                        149
  151    HENRY                                                                        151
  153    HOUSTON                                                                      153
  155    IRWIN                                                                        155
  157    JACKSON                                                                      157
  159    JASPER                                                                       159
  161    JEFF DAVIS         55                                                        161
  163    JEFFERSON                                                                    163
  165    JENKINS            49                                                        165
  167    JOHNSON            55                                                        167
  169    JONES                                                                        169
  171    LAMAR                                                                        171
  173    LANIER                                                           X           173
  175    LAURENS            55                                                        175
  177    LEE                49                                                        177
  179    LIBERTY            24             1                                          179
                            38
                            49
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APPENDIX C (CONTINUED)

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-------------------------------------------- FIPS STATE NUMBER=13   STATE=GEORGIA --------------------------------------------

FIPS_CO    COUNTY                IRP    COAL   CU    G_T   AU    FE   MO   NI   O_S   PEAT   P    AG   U    FIPS_CC

181        LINCOLN
183        LONG                  49                  1                                                     181
                                 55                                                                        183
185        LOWNDES                                                                            X
187        LUMPKIN                            X           X                                                185
189        MCDUFFIE                                                                                        187
191        MCINTOSH              24                  1                                                     189
                                 38                                                                        191
                                 49
                                 55
193        MACON
195        MADISON                                                                                         193
197        MARION                                                                                          195
199        MERIWETHER                                                                                      197
201        MILLER                49                                                                        199
205        MITCHELL              49                                                                        201
207        MONROE                                                                                          205
209        MONTGOMERY            55                  1                                                     207
211        MORGAN                                                                                          209
213        MURRAY                65                                                                        211
217        NEWTON                                                                                          213
219        OCONEE                                                                                          217
221        OGLETHORPE                                                                                      219
223        PAULDING                           X                                                            221
225        PEACH                                                                                           223
227        PICKENS               65                                                                        225
229        PIERCE                55                  1                                                     227
231        PIKE                                                                                            229
233        POLK                                                                 1                          231
235        PULASKI                                                                                         233
237        PUTNAM                                                                                          235
239        QUITMAN                                                                                         237
241        RABUN                                                                                           239
243        RANDOLPH                                                                                        241
245        RICHMOND                                                                                        243
247        ROCKDALE                                                                                        245
249        SCHLEY                                                                                          247
251        SCREVEN               49                                                                        249
                                 55                                                                        251
253        SEMINOLE              49
255        SPALDING                                                                                        253
257        STEPHENS                                                                                        255
259        STEWART                                              X                                          257
261        SUMTER                                                                                          259
263        TALBOT                                                                                          261
265        TALIAFERRO                                                                                      263
267        TATTNALL              49                  1                                                     265
                                 55                                                                        267
269        TAYLOR
271        TELFAIR                                                                                         269
273        TERRELL                                                                                         271
275        THOMAS                49                                                                        273
277        TIFT                                                                                            275
279        TOOMBS                55                  1                                                     277
281        TOWNS                                                                                           279
283        TREUTLEN              55                  1                                                     281
285        TROUP                                                                                           283
287        TURNER                                                                                          285
289        TWIGGS                                                                                          287
291        UNION                                                                                           289
293        UPSON                                                                                           291
295        WALKER                44     1                       X               1                          293
                                 65                                                                        295
297        WALTON
299        WARE                  49                                                                        297
                                 55                                                                        299
301        WARREN
303        WASHINGTON                                                                                      301
305        WAYNE                 49                  1                                                     303
                                 55                                                                        305
307        WEBSTER                                              X
309        WHEELER               55                  1                                                     307
311        WHITE                                          X                                                309
313        WHITFIELD             65                             X               1                          311
315        WILCOX                                                                                          313
317        WILKES                             X                                                            315
319        WILKINSON                                                                                       317
321        WORTH                 49                                                                        319
510        COLUMBUS                                                                                        321
                                                                                                           510

-------------------------------------------- FIPS STATE NUMBER=16   STATE=IDAHO ----------------------------------------------

FIPS_CO    COUNTY                IRP    COAL   CU    G_T   AU    FE   MO   NI   O_S   PEAT   P    AG   U    FIPS_CC

001        ADA                                       3    X
003        ADAMS                 1            X      2               X                                     001
005        BANNOCK                                                                                         003
007        BEAR LAKE                                                                                       005
009        BENEWAH                                                                                         007
011        BINGHAM                                        X                                                009
013        BLAINE                1            X      2    X                                     X          011
                                                                                                           013
```

APPENDIX C (CONTINUED)

FIPS STATE NUMBER=16 STATE=IDAHO

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
015	BOISE	1			2	X		X					X		C15
017	BONNER							X					X		C17
019	BONNEVILLE					X									C19
021	BOUNDARY							X					X		C21
023	BUTTE												X		C23
025	CAMAS				2	X							X		C25
027	CANYON				3										C27
029	CARIBOU				3							X			C29
031	CASSIA				2	X									C31
033	CLARK												X		C33
035	CLEARWATER	1				X	X								C35
037	CUSTER	1		X	2	X		X					X	X	C37
039	ELMORE	1			2	X		X					X		C39
041	FRANKLIN				2										C41
043	FREMONT				2										C43
045	GEM				2	X							X		C45
047	GOODING				2										C47
049	IDAHO	1			2	X		X					X		C49
051	JEFFERSON														C51
053	JEROME				3	X									C53
055	KOOTENAI												X		C55
057	LATAH	1				X									C57
059	LEMHI	1		X	1	X	X	X					X		C59
061	LEWIS	1													C61
063	LINCOLN														C63
065	MADISON				2										C65
067	MINIDOKA														C67
069	NEZ PERCE	1													C69
071	ONEIDA														C71
073	OWYHEE				2	X							X		C73
075	PAYETTE				3										C75
077	POWER					X									C77
079	SHOSHONE			X		X			X				X		C79
081	TETON														C81
083	TWIN FALLS				2	X									C83
085	VALLEY	1			2	X		X					X		C85
087	WASHINGTON				1		X	X					X		C87

FIPS STATE NUMBER=17 STATE=ILLINOIS

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAMS	19 27 66 72 77	2							1					C01
003	ALEXANDER	5 19 66 72 77													C03
005	BOND	19 77	3												C05
007	BOONE	77													C07
009	BROWN	19 66 77	2												C09
011	BUREAU	66 77	3												C11
013	CALHOUN	19 27 66 72 77	1							1					C13
015	CARROLL	19 27 66 72 77													C15
017	CASS	19 66 77	2												C17
019	CHAMPAIGN	77								1					C19
021	CHRISTIAN	77	3												C21
023	CLARK	77	2												C23
025	CLAY	77													C25
027	CLINTON	19 77	3												C27
029	COLES	77	2												C29
031	COOK	11 34 73 77													C31
033	CRAWFORD	77	2												C33
035	CUMBERLAND	77	1												C35
037	DE KALB	77													C37
039	DE WITT	77													C39
041	DOUGLAS	77	2							1					C41
043	DU PAGE	34 77													C43

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=17 STATE=ILLINOIS --

FIPS_CO	COUNTY	INP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
045	EDGAR	77	3												C45
047	EDWARDS	77	2												C47
049	EFFINGHAM	77													C49
051	FAYETTE	19	3												C51
		77													
053	FORD	77													C53
055	FRANKLIN	77	3												C55
057	FULTON	19	3												C57
		66													
		77													
059	GALLATIN	19	3												C59
		77													
061	GREENE	19	2							1					C61
		66													
		77													
063	GRUNDY	77	2												C63
065	HAMILTON	77	3												C65
067	HANCOCK	19	2												C67
		27													
		66													
		72													
		77													
069	HARDIN	19											X		C69
		77													
071	HENDERSON	19								1					C71
		27													
		66													
		72													
		77													
073	HENRY	77	2												C73
075	IROQUOIS	77								1					C75
077	JACKSON	19	2												C77
		66													
		72													
		77													
079	JASPER	77													C79
081	JEFFERSON	77	3												C81
083	JERSEY	19	2							1					C83
		27													
		66													
		72													
		77													
085	JO DAVIESS	19													C85
		27													
		66													
		72													
		77													
087	JOHNSON	77													C87
089	KANE	77													C89
091	KANKAKEE	77	2												C91
093	KENDALL	77													C93
095	KNOX	77	2												C95
097	LAKE	11													C97
		38													
		73													
		77													
C99	LA SALLE	77	3												C99
101	LAWRENCE	77	2												101
103	LEE	77													103
105	LIVINGSTON	77	2												105
107	LOGAN	19	2												107
		77													
109	MCDONOUGH	77	2												109
111	MCHENRY	77													111
113	MCLEAN	77	2												113
115	MACON	77	2												115
117	MACOUPIN	77	3												117
119	MADISON	19	3												119
		27													
		66													
		72													
		77													
121	MARION	77	2												121
123	MARSHALL	19	2												123
		66													
		77													
125	MASON	19													125
		66													
		77													
127	MASSAC	5													127
		19													
		77													
129	MENARD	19	3												129
		77													
131	MERCER	19	2							1					131
		27													
		66													
		72													
		77													
133	MONROE	19	1												133
		66													
		72													

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=17 STATE=ILLINOIS ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
		77													
135	MONTGOMERY	77	3												135
137	MORGAN	19	2												137
		66													
		77													
139	MOULTRIE	19	2												139
		77													
141	OGLE	77													141
143	PEORIA	19	3												143
		66													
		77													
145	PERRY	77	3												145
147	PIATT	77													147
149	PIKE	19								1					149
		27													
		66													
		72													
		77													
151	POPE	19													151
		77													
153	PULASKI	5													153
		19													
		66													
		77													
155	PUTNAM	66	2												155
		77													
157	RANDOLPH	19	2												157
		66													
		72													
		77													
159	RICHLAND	77													159
161	ROCK ISLAND	19	2							1					161
		27													
		66													
		72													
		77													
163	ST CLAIR	19	3												163
		66													
		72													
		77													
165	SALINE	77	3												165
167	SANGAMON	77	3												167
169	SCHUYLER	19	2												169
		66													
		77													
171	SCOTT	19	2							1					171
		66													
		77													
173	SHELBY	19	2												173
		77													
175	STARK	77	2												175
177	STEPHENSON	77													177
179	TAZEWELL	19	2												179
		66													
		77													
181	UNION	19													181
		66													
		72													
		77													
183	VERMILION	77	3							1					183
185	WABASH	77	2												185
187	WARREN	77	2							1					187
189	WASHINGTON	19	3												189
		77													
191	WAYNE	77	2												191
193	WHITE	77	2												193
195	WHITESIDE	19													195
		27													
		66													
		72													
		77													
197	WILL	77	2												197
199	WILLIAMSON	77	3												199
201	WINNEBAGO	77													201
203	WOODFORD	19	2												203
		66													
		77													

--- FIPS STATE NUMBER=18 STATE=INDIANA ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAMS	11													C01
		77													
003	ALLEN	11													C03
		77													
005	BARTHOLOMEW	71								1					C05
		77													
007	BENTON	71								1					C07
		77													
009	BLACKFORD	77													C09

APPENDIX C (CONTINUED)

---------- FIPS STATE NUMBER=18 STATE=INDIANA ----------

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
011	BOONE	71 77								1					C11
013	BROWN	71 77					*			*					C13
015	CARROLL	71 77								1					C15
017	CASS	71 77					*								C17
019	CLARK	19 71 77					*			1					C19
021	CLAY	77	2				*			*					C21
023	CLINTON	71 77								1					C23
025	CRAWFORD	19 71 77								*					C25
027	DAVIESS	77	2				*			*					C27
029	DEARBORN	19 77													C29
031	DECATUR	77													C31
033	DE KALB	11 71 77								1					C33
035	DELAWARE	77													C35
037	DUBOIS	71 77	1				*			*					C37
039	ELKHART	11 71 77					*			1					C39
041	FAYETTE	77													C41
043	FLOYD	19 71 77					*			1					C43
045	FOUNTAIN	71 77	2				X			*					C45
047	FRANKLIN	77													C47
049	FULTON	71 77					*			1					C49
051	GIBSON	77	3							*					C51
053	GRANT	77													053
055	GREENE	71 77	2				X			*					C55
057	HAMILTON	71 77													057
059	HANCOCK	71 77													C59
061	HARRISON	19 71 77								*					C61
063	HENDRICKS	71 77								1					C63
065	HENRY	77													C65
067	HOWARD	71 77													C67
069	HUNTINGTON	77													C69
071	JACKSON	71 77					*			1					C71
073	JASPER	71 77					*			1					C73
075	JAY	77													C75
077	JEFFERSON	19 77								1					C77
079	JENNINGS	71 77								1					C79
081	JOHNSON	71 77								1					C81
083	KNOX	77	3							*					083
085	KOSCIUSKO	11 71 77					*			1					C85
087	LAGRANGE	11 71 77					*			*					C87
089	LAKE	11 71 73 77					*			1					C89
091	LA PORTE	11 71 73 77					*			1					091
093	LAWRENCE	71 77					*			*					C93
095	MADISON	77													C95
097	MARION	71 77								1					C97
099	MARSHALL	71 77					*			1					C99
101	MARTIN	71 77	2				X			*					101
103	MIAMI	71													103

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                                              APPENDIX C (CONTINUED)
------------------------------------------------- FIPS STATE NUMBER=18   STATE=INDIANA ------------------------------------------------

FIPS_CO   COUNTY                  IRP   COAL   CU    G_T   AU    FE    MO    NI    O_S    PEAT   P    AG    U    FIPS_CC

                                  77
105       MONROE                  71                             *                 *                             105
                                  77
107       MONTGOMERY              71                                               *                             107
                                  77
109       MORGAN                  71                             *                 *                             109
                                  77
111       NEWTON                  71                             *                 1                             111
                                  77
113       NOBLE                   11                             *                 1                             113
                                  71
                                  77
115       OHIO                    77                                                                             115
117       ORANGE                  71                                               *                             117
                                  77
119       OWEN                    71    2                                          *                             119
                                  77
121       PARKE                   77    2                        *                                               121
123       PERRY                   19    2                        *                 *                             123
                                  71
                                  77
125       PIKE                    77    2                                          *                             125
127       PORTER                  11                             *                 1                             127
                                  71
                                  73
                                  77
129       POSEY                   19    2                                          *                             129
                                  77
131       PULASKI                 71                             *                 1                             131
                                  77
133       PUTNAM                  71                                               *                             133
                                  77
135       RANDOLPH                77                                                                             135
137       RIPLEY                  77                                                                             137
139       RUSH                    77                                                                             139
141       ST JOSEPH               11                             *                 1                             141
                                  71
                                  77
143       SCOTT                   71                             I                 1                             143
                                  77
145       SHELBY                  71                                                                             145
                                  77
147       SPENCER                 19    2                        *                 *                             147
                                  71
                                  77
149       STARKE                  71                             *                 1                             149
                                  77
151       STEUBEN                 11                             *                 *                             151
                                  71
                                  77
153       SULLIVAN                77    3                                          *                             153
155       SWITZERLAND             19                                                                             155
                                  77
157       TIPPECANOE              71                                               1                             157
                                  77
159       TIPTON                  71                                                                             159
                                  77
161       UNION                   77                                                                             161
163       VANDERBURGH             19    2                                          *                             163
                                  77
165       VERMILLION              77    2                        I                 *                             165
167       VIGO                    77    3                                          *                             167
169       WABASH                  71                                                                             169
                                  77
171       WARREN                  71    *                                          1                             171
                                  77
173       WARRICK                 19    2                                          *                             173
                                  77
175       WASHINGTON              71                             *                 *                             175
                                  77
177       WAYNE                   77                                                                             177
179       WELLS                   77                                                                             179
181       WHITE                   71                             *                 1                             181
                                  77
183       WHITLEY                 71                                                                             183
                                  77

------------------------------------------------- FIPS STATE NUMBER=19   STATE=IOWA ---------------------------------------------------

FIPS_CC   COUNTY                  IRP   COAL   CU    G_T   AU    FE    MO    NI    O_S    PEAT   P    AG    U    FIPS_CC

001       ADAIR                    6                                                                             001
003       ADAMS                    6                                                                             003
005       ALLAMAKEE               19                             I                                               005
                                  27
                                  66
                                  72
                                  77
007       APPANOOSE                     2                                                                        007
009       AUDUBON                  6                                                                             009
011       BENTON                                                                                                 011
```

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=19 STATE=IOWA --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
013	BLACK HAWK														013
015	BOONE		2												015
017	BREMER														017
019	BUCHANAN														019
021	BUENA VISTA	6													021
023	BUTLER	6													023
025	CALHOUN	6													025
027	CARROLL	6													027
029	CASS	6	1												029
031	CEDAR														031
033	CERRO GORDO	6													033
035	CHEROKEE	6													035
037	CHICKASAW														037
039	CLARKE														039
041	CLAY	6													041
043	CLAYTON	19 27 66 72 77													043
045	CLINTON	19 27 66 72 77													045
047	CRAWFORD	6													047
049	DALLAS	6	2												049
051	DAVIS		2												051
053	DECATUR		2												053
055	DELAWARE														055
057	DES MOINES	19 27 66 72 77													057
059	DICKINSON	6													059
061	DUBUQUE	19 27 66 72 77													061
063	EMMET	6													063
065	FAYETTE														065
067	FLOYD	6													067
069	FRANKLIN	6													069
071	FREMONT	6													071
073	GREENE	6	2												073
075	GRUNDY														075
077	GUTHRIE	6	1												077
079	HAMILTON	6	1												079
081	HANCOCK	6													081
083	HARDIN	6	1												083
085	HARRISON	6													085
087	HENRY		1												087
089	HOWARD														089
091	HUMBOLDT	6													091
093	IDA	6													093
095	IOWA														095
097	JACKSON	19 27 66 72 77													097
099	JASPER		2												099
101	JEFFERSON		2												101
103	JOHNSON														103
105	JONES														105
107	KEOKUK		2												107
109	KOSSUTH	6													109
111	LEE	19 27 66 72 77	1												111
113	LINN														113
115	LOUISA	19 27 66 72 77													115
117	LUCAS		2												117
119	LYON	6													119
121	MADISON	6													121
123	MAHASKA		2												123
125	MARION		2												125
127	MARSHALL		1												127
129	MILLS	6													129
131	MITCHELL	6													131
133	MONONA	6													133
135	MONROE		2												135
137	MONTGOMERY	6													137
139	MUSCATINE	19													139

APPENDIX C (CONTINUED)

---------- FIPS STATE NUMBER=19 STATE=IOWA ----------

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		27 66 72 77													
141	O BRIEN	6													141
143	OSCEOLA	6													143
145	PAGE	6													145
147	PALO ALTO	6													147
149	PLYMOUTH	6													149
151	POCAHONTAS	6													151
153	POLK		2												153
155	POTTAWATTAMIE	6													155
157	POWESHIEK														157
159	RINGGOLD	6													159
161	SAC	6													161
163	SCOTT	19 27 66 72 77	1												163
165	SHELBY	6													165
167	SIOUX	6													167
169	STORY		2												169
171	TAMA														171
173	TAYLOR	6													173
175	UNION	6													175
177	VAN BUREN		2												177
179	WAPELLO		2												179
181	WARREN		2												181
183	WASHINGTON														183
185	WAYNE														185
187	WEBSTER	6	2												187
189	WINNEBAGO	6													189
191	WINNESHIEK														191
193	WOODBURY	6													193
195	WORTH	6													195
197	WRIGHT	6													197

---------- FIPS STATE NUMBER=20 STATE=KANSAS ----------

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ALLEN														001
003	ANDERSON	6													003
005	ATCHISON	6	1												005
007	BARBER														007
009	BARTON	6													009
011	BOURBON		2												011
013	BROWN	6	2												013
015	BUTLER	6													015
017	CHASE	6													017
019	CHAUTAUQUA	6													019
021	CHEROKEE		2												021
023	CHEYENNE														023
025	CLARK	59													025
027	CLAY	6													027
029	CLOUD	6													029
031	COFFEY	6													031
033	COMANCHE														033
035	COWLEY	6	1												035
037	CRAWFORD		2												037
039	DECATUR														039
041	DICKINSON	6													041
043	DONIPHAN	6													043
045	DOUGLAS	6													045
047	EDWARDS														047
049	ELK	6													049
051	ELLIS	6													051
053	ELLSWORTH	6													053
055	FINNEY	59													055
057	FORD	59													057
059	FRANKLIN	6	1												059
061	GEARY	6													061
063	GOVE	59													063
065	GRAHAM														065
067	GRANT	59													067
069	GRAY	59													069
071	GREELEY	59													071
073	GREENWOOD	6													073
075	HAMILTON	59													075
077	HARPER														077
079	HARVEY	6													079
081	HASKELL	59													081
083	HODGEMAN	59													083
085	JACKSON	6													085
087	JEFFERSON	6													087
089	JEWELL	6													089
091	JOHNSON	6													091
093	KEARNY	59													093
095	KINGMAN														095
097	KIOWA														097

APPENDIX C (CONTINUED)

FIPS STATE NUMBER=20 STATE=KANSAS

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
099	LABETTE														099
101	LANE	59													101
103	LEAVENWORTH	6	2												103
105	LINCOLN	6													105
107	LINN		2												107
109	LOGAN	59													109
111	LYON	6													111
113	MCPHERSON	6													113
115	MARION	6													115
117	MARSHALL	6													117
119	MEADE	59													119
121	MIAMI	6													121
123	MITCHELL	6													123
125	MONTGOMERY														125
127	MORRIS	6													127
129	MORTON	59													129
131	NEMAHA	6	1												131
133	NEOSHO														133
135	NESS	59													135
137	NORTON	6													137
139	OSAGE	6	2												139
141	OSBORNE	6													141
143	OTTAWA	6													143
145	PAWNEE														145
147	PHILLIPS	6													147
149	POTTAWATOMIE	6													149
151	PRATT														151
153	RAWLINS														153
155	RENO	6													155
157	REPUBLIC	6													157
159	RICE	6													159
161	RILEY	6													161
163	ROOKS	6													163
165	RUSH														165
167	RUSSELL	6													167
169	SALINE	6													169
171	SCOTT	59													171
173	SEDGWICK	6													173
175	SEWARD	59													175
177	SHAWNEE	6													177
179	SHERIDAN	59													179
181	SHERMAN	59													181
183	SMITH	6													183
185	STAFFORD														185
187	STANTON	59													187
189	STEVENS	59													189
191	SUMNER	6													191
193	THOMAS	59													193
195	TREGO	59													195
197	WABAUNSEE	6													197
199	WALLACE	59													199
201	WASHINGTON	6													201
203	WICHITA	59													203
205	WILSON														205
207	WOODSON	6													207
209	WYANDOTTE														209

FIPS STATE NUMBER=21 STATE=KENTUCKY

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAIR	44								1					001
003	ALLEN	44								1					003
005	ANDERSON	44													005
007	BALLARD	5 19 77													007
009	BARREN	44								1					009
011	BATH	44 65					X			1					011
013	BELL	44 65	2							1					013
015	BOONE	19 77													015
017	BOURBON	44													017
019	BOYD	77	2												019
021	BOYLE	44								1					021
023	BRACKEN	19 77													023
025	BREATHITT	44 65	2												025
027	BRECKINRIDGE	19 44 71 77													027
029	BULLITT	44 71 77								1					029
031	BUTLER	44	2												031
033	CALDWELL	44	*												033
035	CALLOWAY	5													035

APPENDIX C (CONTINUED)

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----------------------------------------------- FIPS STATE NUMBER=21   STATE=KENTUCKY -----------------------------------------------
FIPS_CO     COUNTY                IRP   COAL   CU   G_T   AU   FE   MO   NI   O_S   PEAT   P   AG   U   FIPS_CC
                                   44
037         CAMPBELL               19                                                                    037
                                   77
039         CARLISLE                5                                                                    039
041         CARROLL                19                                                                    041
                                   77
043         CARTER                 65     2                    X                                         043
045         CASEY                  44                                          1                         045
047         CHRISTIAN              44     2                                                              047
049         CLARK                  44                                          1                         049
                                   65
051         CLAY                   44     2                                                              051
                                   65
053         CLINTON                44     1                                    1                         053
055         CRITTENDEN             19     2                                                              055
                                   77
057         CUMBERLAND             44                                          1                         057
059         DAVIESS                19     2                                                              059
                                   44
                                   77
061         EDMONSON               44     2                                    2                         061
063         ELLIOTT                44     2                                                              063
                                   65
065         ESTILL                 44     *                                    1                         065
                                   65
067         FAYETTE                44                                                                    067
069         FLEMING                44                                          1                         069
                                   65
071         FLOYD                  44     3                                                              071
                                   65
073         FRANKLIN               44                                                                    073
075         FULTON                  5                                                                    075
077         GALLATIN               19                                                                    077
                                   77
079         GARRARD                44                                          1                         079
081         GRANT                                                                                        081
083         GRAVES                  5                                                                    083
                                   44
085         GRAYSON                44     2                                                              085
087         GREEN                  44                                                                    087
089         GREENUP                65     2                    X                                         089
                                   77
091         HANCOCK                19     2                                                              091
                                   44
                                   71
                                   77
093         HARDIN                 19                                                                    093
                                   44
                                   71
                                   77
095         HARLAN                 65     3                                    1                         095
097         HARRISON               44                                                                    097
099         HART                   44     *                                                              099
101         HENDERSON              19     3                                                              101
                                   77
103         HENRY                                                                                        103
105         HICKMAN                 5                                                                    105
107         HOPKINS                44     3                                                              107
109         JACKSON                44     2                                                              109
                                   65
111         JEFFERSON              19                                          1                         111
                                   71
113         JESSAMINE              44                                                                    113
115         JOHNSON                44     2                                                              115
                                   65
117         KENTON                 19                                                                    117
                                   77
119         KNOTT                  44     3                                                              119
                                   65
121         KNOX                   44     2                                                              121
                                   65
123         LARUE                  44                                                                    123
125         LAUREL                 44     2                                                              125
                                   65
127         LAWRENCE               65     2                                                              127
129         LEE                    44     2                                                              129
                                   65
131         LESLIE                 44     2                                                              131
                                   65
133         LETCHER                65     2                                    1                         133
135         LEWIS                  19     *                                    1                         135
                                   65
                                   77
137         LINCOLN                44                                          1                         137
139         LIVINGSTON             19                                                            X       139
                                   77
141         LOGAN                  44     *                                    2                         141
143         LYON                   44                          X                                         143
145         MCCRACKEN               5                                                                    145
                                   19
                                   77
147         MCCREARY               44     2                                                              147
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APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=21 STATE=KENTUCKY ---

FIPS_CC	COUNTY	IPP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		65													
149	MCLEAN	44	2												149
151	MADISON	44 65								1					151
153	MAGOFFIN	44 65	2												153
155	MARION	44								1					155
157	MARSHALL	44													157
159	MARTIN	65	2												159
161	MASON	19 65 77													161
163	MEADE	19 71 77													163
165	MENIFEE	44 65	1							1					165
167	MERCER	44													167
169	METCALFE	44													169
171	MONROE	44								1					171
173	MONTGOMERY	44 65								1					173
175	MORGAN	44 65	2												175
177	MUHLENBERG	44	3												177
179	NELSON	44								1					179
181	NICHOLAS	44 65													181
183	OHIO	44	2												183
185	OLDHAM	19 77								1					185
187	OWEN	44					X								187
189	OWSLEY	44 65	1												189
191	PENDLETON	19 77													191
193	PERRY	44 65	3							1					193
195	PIKE	65	3							1					195
197	POWELL	44 65	1							1					197
199	PULASKI	44 65	2							1					199
201	ROBERTSON	44 65													201
203	ROCKCASTLE	44 65	2							1					203
205	ROWAN	44 65	*							1					205
207	RUSSELL	44								1					207
209	SCOTT	44													209
211	SHELBY	44													211
213	SIMPSON	44													213
215	SPENCER	44													215
217	TAYLOR	44								1					217
219	TODD	44	*												219
221	TRIGG	44					X								221
223	TRIMBLE	19 77													223
225	UNION	19 77	3												225
227	WARREN	44	1												227
229	WASHINGTON	44													229
231	WAYNE	44 65	2												231
233	WEBSTER		3												233
235	WHITLEY	44 65	2							1					235
237	WOLFE	44 65	2												237
239	WOODFORD	44													239

--- FIPS STATE NUMBER=22 STATE=LOUISIANA ---

FIPS_CC	CCUNTY	IPP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ACADIA	49									2				001
003	ALLEN	49													003
005	ASCENSION	5 7 49									2				005
007	ASSUMPTION	5 7 49									2				007
009	AVOYELLES	5 49													009
011	BEAUREGARD	49													011
013	BIENVILLE	5	*												013
015	BOSSIER		*				X								015
017	CADDO		*												017
019	CALCASIEU	7									2				019

APPENDIX C (CONTINUED)

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--------------------------------------------- FIPS STATE NUMBER=22   STATE=LOUISIANA ---------------------------------------------

FIPS_CO     COUNTY                 IMP   COAL   CU   G_T   AU   FE   MO   NI   O_S   PEAT   P   AG   U   FIPS_CC

                                    49
021         CALDWELL                 5    *                                                              021
023         CAMERON                  7                                                  1                 023
                                    24
                                    49
025         CATAHOULA                5                                                                   025
027         CLAIBORNE                5    *                      X                                       027
029         CONCORDIA                5                                                                   029
                                    49
031         DE SOTO                       *                                                              031
033         EAST BATON ROUGE         5                                                                   033
                                    49
035         EAST CARROLL             5                                                                   035
                                    49
037         EAST FELICIANA           5                                                                   037
039         EVANGELINE               5                                                                   039
                                    49
041         FRANKLIN                 5                                                                   041
043         GRANT                    5    *                                                              043
045         IBERIA                   5                                                  1                 045
                                     7
                                    24
                                    49
047         IBERVILLE                5                                                  2                 047
                                     7
                                    49
049         JACKSON                  5    *                                                              049
051         JEFFERSON                7                                                  1                 051
                                    24
                                    49
053         JEFFERSON DAVIS          7                                                  1                 053
                                    49
055         LAFAYETTE                7                                                  1                 055
                                    49
057         LAFOURCHE                7                                                  1                 057
                                    24
                                    49
059         LA SALLE                 5                                                                   059
061         LINCOLN                  5    *                      X                                       061
063         LIVINGSTON               5                                                  2                 063
                                    49
065         MADISON                  5                                                                   065
                                    49
067         MOREHOUSE                5                                                                   067
069         NATCHITOCHES                  *                                                              069
071         ORLEANS                  7                                                  1                 071
                                    49
073         OUACHITA                 5    *                                                              073
075         PLAQUEMINES              7                                                  1                 075
                                    24
                                    49
077         POINTE COUPEE            5                                                  2                 077
                                    49
079         RAPIDES                  5                                                                   079
                                    49
081         RED RIVER                     *                                                              081
083         RICHLAND                 5    *                                                              083
085         SABINE                  49    *                                                              085
087         ST BERNARD               7                                                  2                 087
                                    24
                                    49
089         ST CHARLES               7                                                  1                 089
                                    49
091         ST HELENA                5                                                                   091
093         ST JAMES                 5                                                  1                 093
                                     7
                                    49
095         ST JOHN THE BAPTIST      5                                                  1                 095
                                     7
                                    49
097         ST LANDRY                5                                                                   097
                                    49
099         ST MARTIN                5                                                  2                 099
                                     7
                                    49
101         ST MARY                  5                                                  2                 101
                                     7
                                    24
                                    49
103         ST TAMMANY               5                                                  2                 103
                                    49
105         TANGIPAHOA               5                                                  2                 105
                                    49
107         TENSAS                   5                                                                   107
                                    49
109         TERREBONNE               7                                                  1                 109
                                    24
                                    49
111         UNION                    5    *                                                              111
113         VERMILION                7                                                  1                 113
                                    24
                                    49
```

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=22 STATE=LOUISIANA --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
115	VERNON	49													115
117	WASHINGTON	5 49													117
119	WEBSTER		*				X								119
121	WEST BATON ROUGE	5 49													121
123	WEST CARROLL	5	*												123
125	WEST FELICIANA	5 49													125
127	WINN	5	*												127

-- FIPS STATE NUMBER=23 STATE=MAINE --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ANDROSCOGGIN	19 36 76													001
003	AROOSTOOK	26 36 76					X	X			2				003
005	CUMBERLAND	36 76													005
007	FRANKLIN	36 76													007
009	HANCOCK	19 26 36 68 76		X				X			2		X		009
011	KENNEBEC	19 26 36 76													011
013	KNOX	19 26 36 76							X						013
015	LINCOLN	19 26 36 76													015
017	OXFORD	36 76													017
019	PENOBSCOT	19 26 36 76									2				019
021	PISCATAQUIS	19 26 36 76					X		X		2				021
023	SAGADAHOC	19 26 36 76													023
025	SOMERSET	19 26 36 76		X				X	X						025
027	WALDO	19 26 36 76													027
029	WASHINGTON	19 26 36 68 76						X			2				029
031	YORK	24 36 76													031

-- FIPS STATE NUMBER=24 STATE=MARYLAND --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ALLEGANY	51 76	2				X								001
003	ANNE ARUNDEL	18 19 27 51 76					X								003
005	BALTIMORE	18 19 27 51 76		X											005
009	CALVERT	18													009

APPENDIX C (CONTINUED)

-------------------- FIPS STATE NUMBER=24 STATE=MARYLAND --------------------

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		19													
		27													
		51													
		76													
011	CAROLINE	19													011
		51													
013	CARROLL	14		X			X								013
		19													
		51													
		76													
015	CECIL	14													015
		19													
		27													
		51													
		76													
017	CHARLES	14													017
		19													
		27													
		51													
		76													
019	DORCHESTER	14													019
		19													
		27													
		51													
021	FREDERICK	14		X			X								021
		19													
		51													
		76													
023	GARRETT	51	2		1										023
		76													
025	HARFORD	14					X								025
		19													
		27													
		51													
		76													
027	HOWARD	14													027
		19													
		51													
		76													
029	KENT	14													029
		19													
		27													
		51													
031	MONTGOMERY	14													031
		19													
		51													
		76													
033	PRINCE GEORGES	14													033
		19													
		51													
		76													
035	QUEEN ANNES	14													035
		19													
		27													
		51													
037	ST MARYS	14													037
		19													
		27													
		51													
039	SOMERSET	14													039
		19													
		27													
		51													
041	TALBOT	14													041
		19													
		27													
		51													
043	WASHINGTON	51													043
		76													
045	WICOMICO	14													045
		19													
		27													
		51													
047	WORCESTER	19													047
		24													
		51													

-------------------- FIPS STATE NUMBER=25 STATE=MASSACHUSETTS --------------------

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	BARNSTABLE	36													001
003	BERKSHIRE	22					X								003
		36													
005	BRISTOL	36													005
007	DUKES	36													007
009	ESSEX	26													009
		36													
011	FRANKLIN	22		X											011
		26													
		36													

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=25 STATE=MASSACHUSETTS --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
013	HAMPDEN	22 26 36													013
015	HAMPSHIRE	22 26 36													015
017	MIDDLESEX	26 36													017
019	NANTUCKET	36													019
021	NORFOLK	36													021
023	PLYMOUTH	36													023
025	SUFFOLK	36													025
027	WORCESTER	36													027

-- FIPS STATE NUMBER=26 STATE=MICHIGAN --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ALCONA	11 23 61 71 73								1	2				001
003	ALGER	11 19 71 73									2				003
005	ALLEGAN	11 38 71 73 77													005
007	ALPENA	11 23 71 73								1	2				007
009	ANTRIM	11 73								1	2				009
011	ARENAC	11 38 61 71 73									2				011
013	BARAGA	11 19 73					X				2				013
015	BARRY	11 38 71 77													015
017	BAY	11 38 61 71 73 77	2								2				017
019	BENZIE	11 71 73								1	2				019
021	BERRIEN	11 38 71 73 77								1					021
023	BRANCH	11 38 71 77													023
025	CALHOUN	11 38 71 77													025
027	CASS	11 38 71 77													027
029	CHARLEVOIX	11 73								1	2				029
031	CHEBOYGAN	11 71 73								1	2				031
033	CHIPPEWA	11 19 71 73									1				033
035	CLARE	11 71 77									2				035
037	CLINTON	11 38 71													037

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=26 STATE=MICHIGAN --

FIPS_CO	COUNTY	IPP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
039	CRAWFORD	77 11 23									1				C39
041	DELTA	71 11 19 71									1				C41
043	DICKINSON	73 11 19					X				2				C43
045	EATON	71 11 34 71													C45
047	EMMET	77 11 71								1	2				C47
049	GENESEE	73 11 34	1												C49
051	GLADWIN	77 11 71									2				C51
053	GOGEBIC	77 11 19		X			X				2				C53
055	GRAND TRAVERSE	73 11 71								1	2				C55
057	GRATIOT	73 11 34 71													C57
059	HILLSDALE	77 11 34 71													C59
061	HOUGHTON	77 11 19		X							2		X		C61
063	HURON	73 11 34 61 73	1												C63
065	INGHAM	77 11 34 71													C65
067	IONIA	77 11 34 71													C67
069	IOSCO	77 11 23 34 61 71									2				C69
071	IRON	73 11 19					X				1				C71
073	ISABELLA	71 11 71									2				C73
075	JACKSON	77 11 34 71													C75
077	KALAMAZOO	77 11 34 71													C77
079	KALKASKA	77 11 71								1	1				C79
081	KENT	73 11 34 71													C81
083	KEWEENAW	77 11 19		X							2				C83
085	LAKE	73 11 71									2				C85
087	LAPEER	77 11 34													C87
089	LEELANAU	77 11 73								1	2				C89

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=26   STATE=MICHIGAN --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
091	LENAWEE	11								1					091
		34													
		71													
		77													
093	LIVINGSTON	11													093
		34													
		71													
		77													
095	LUCE	11									1				095
		19													
		71													
		73													
097	MACKINAC	11									1				097
		19													
		71													
		73													
099	MACOMB	11								1					099
		34													
		61													
		73													
		77													
101	MANISTEE	11								1	2				101
		71													
		73													
103	MARQUETTE	11				X	X				2				103
		19													
		71													
		73													
105	MASON	11								1	2				105
		73													
		77													
107	MECOSTA	11													107
		71													
		77													
109	MENOMINEE	11									2				109
		19													
		71													
		73													
111	MIDLAND	11									2				111
		34													
		71													
		77													
113	MISSAUKEE	11									1				113
		23													
		71													
115	MONROE	11								1					115
		34													
		61													
		73													
		77													
117	MONTCALM	11													117
		34													
		71													
		77													
119	MONTMORENCY	11								1	2				119
		23													
		71													
121	MUSKEGON	11													121
		73													
		77													
123	NEWAYGO	11													123
		71													
		77													
125	OAKLAND	11													125
		34													
		77													
127	OCEANA	11													127
		73													
		77													
129	OGEMAW	11									2				129
		23													
		71													
131	ONTONAGON	11		X							2		X		131
		19													
		73													
133	OSCEOLA	11									2				133
		71													
		77													
135	OSCODA	11									2				135
		23													
		71													
137	OTSEGO	11								1	2				137
		23													
		71													
139	OTTAWA	11													139
		34													
		73													
		77													
141	PRESQUE ISLE	11									2				141
		23													
		71													
		73													

APPENDIX C (CONTINUED)

---------- FIPS STATE NUMBER=26 STATE=MICHIGAN ----------

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
143	ROSCOMMON	11									1				143
		23													
		71													
145	SAGINAW	11	2												145
		34													
		71													
		77													
147	ST CLAIR	11								1					147
		34													
		61													
		73													
		77													
149	ST JOSEPH	11													149
		34													
		71													
		77													
151	SANILAC	11								1					151
		34													
		61													
		73													
		77													
153	SCHOOLCRAFT	11									1				153
		19													
		71													
		73													
155	SHIAWASSEE	11	1												155
		34													
		71													
		77													
157	TUSCOLA	11	2												157
		34													
		61													
		73													
		77													
159	VAN BUREN	11													159
		34													
		71													
		73													
		77													
161	WASHTENAW	11								1					161
		34													
		71													
		77													
163	WAYNE	11								1					163
		34													
		61													
		73													
		77													
165	WEXFORD	11									2				165
		71													

---------- FIPS STATE NUMBER=27 STATE=MINNESOTA ----------

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
001	AITKIN	11									1				001
		19													
		34													
		71													
		77													
003	ANOKA	34									2				003
		71													
		77													
005	BECKER	6									2				005
		19													
		71													
		77													
007	BELTRAMI	6									1				007
		19													
		34													
		71													
		77													
009	BENTON	6									2				009
		71													
		77													
011	BIG STONE	6													011
013	BLUE EARTH	77									2				013
015	BROWN	6									2				015
017	CARLTON	11									1				017
		19													
		34													
		77													
019	CARVER	66									2				019
		77													
021	CASS	6									1				021
		19													
		34													
		71													
		77													
023	CHIPPEWA	6													023
025	CHISAGO	19									2				025

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=27 STATE=MINNESOTA ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		34													
		71													
		77													
027	CLAY	6													027
		71													
029	CLEARWATER	6									1				029
		19													
		34													
		71													
		77													
031	COOK	11					X				2				031
		19													
		73													
033	COTTONWOOD	6													033
035	CROW WING	6					X				1				035
		19													
		34													
		71													
		77													
037	DAKOTA	19									2				037
		66													
		72													
		77													
039	DODGE	77													039
041	DOUGLAS	6									2				041
		77													
043	FARIBAULT										2				043
045	FILLMORE	77					X								045
047	FREEBORN	77									2				047
049	GOODHUE	19													049
		66													
		72													
		77													
051	GRANT	6													051
053	HENNEPIN	66									2				053
		77													
055	HOUSTON	19													055
		27													
		66													
		72													
		77													
057	HUBBARD	6									2				057
		19													
		34													
		71													
		77													
059	ISANTI	34									2				059
		71													
		77													
061	ITASCA	11					X				1				061
		19													
		34													
		71													
		77													
063	JACKSON	6													063
065	KANABEC	19									2				065
		34													
		71													
		77													
067	KANDIYOHI	6									2				067
069	KITTSON	6									1				069
		34													
		71													
071	KOOCHICHING	19									1				071
		34													
		71													
073	LAC QUI PARLE	6													073
075	LAKE	11		X		X	X		X		2		X		075
		19													
		73													
077	LAKE OF THE WOODS	19									1				077
		34													
		71													
079	LE SUEUR	77									2				079
081	LINCOLN	6													081
083	LYON	6													083
085	MCLEOD	6									2				085
		77													
087	MAHNOMEN	6									2				087
		19													
		71													
		77													
089	MARSHALL	6									1				089
		19													
		34													
		71													
091	MARTIN	6													091
093	MEEKER	6									2				093
095	MILLE LACS	19									2				095
		34													
		71													
		77													

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=27 STATE=MINNESOTA --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
097	MORRISON	6									2				097
		71													
		77													
099	MOWER	77													099
101	MURRAY	6													101
103	NICOLLET	6									2				103
105	NOBLES	6													105
107	NORMAN	6													107
		71													
109	OLMSTED	77													109
111	OTTER TAIL	6									2				111
		71													
		77													
113	PENNINGTON	6									1				113
		19													
		38													
		71													
115	PINE	11									2				115
		19													
		38													
		71													
		77													
117	PIPESTONE	6													117
119	POLK	6									1				119
		19													
		38													
		71													
		77													
121	POPE	6									2				121
123	RAMSEY	66									2				123
		72													
		77													
125	RED LAKE	6									1				125
		19													
		38													
		71													
127	REDWOOD	6													127
129	RENVILLE	6													129
131	RICE	77									2				131
133	ROCK	6													133
135	ROSEAU	6									1				135
		19													
		38													
		71													
137	ST LOUIS	11		X			X		X		1				137
		19													
		38													
		73													
		77													
139	SCOTT	66									2				139
		77													
141	SHERBURNE	71									2				141
		77													
143	SIBLEY	6									2				143
		77													
145	STEARNS	6									2				145
		77													
147	STEELE	77									2				147
149	STEVENS	6													149
151	SWIFT	6													151
153	TODD	6									2				153
		71													
		77													
155	TRAVERSE	6													155
157	WABASHA	19													157
		27													
		66													
		72													
		77													
159	WADENA	6									2				159
		19													
		71													
		77													
161	WASECA	77									2				161
163	WASHINGTON	19									2				163
		38													
		66													
		72													
		77													
165	WATONWAN	6													165
167	WILKIN	6													167
169	WINONA	19													169
		27													
		66													
		72													
		77													
171	WRIGHT	6									2				171
		77													
173	YELLOW MEDICINE	6													173

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=28 STATE=MISSISSIPPI ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAMS	5 49													001
003	ALCORN	5 44													003
005	AMITE	5													005
007	ATTALA	5													007
009	BENTON	5	*												009
011	BOLIVAR	5 49													011
013	CALHOUN	5													013
015	CARROLL	5													015
017	CHICKASAW	5													017
019	CHOCTAW	5	*				X								019
021	CLAIBORNE	5 49	*												021
023	CLARKE	49													023
025	CLAY														025
027	COAHOMA	5													027
029	COPIAH	5													029
031	COVINGTON														031
033	DE SOTO	5	*												033
035	FORREST	49													035
037	FRANKLIN	5													037
039	GEORGE	49 50													039
041	GREENE	49													041
043	GRENADA	5													043
045	HANCOCK	24 49 50													045
047	HARRISON	24 49 50													047
049	HINDS	5													049
051	HOLMES	5	*												051
053	HUMPHREYS,	5													053
055	ISSAQUENA	5 49													055
057	ITAWAMBA														057
059	JACKSON	24 49 50													059
061	JASPER		*												061
063	JEFFERSON	5 49													063
065	JEFFERSON DAVIS														065
067	JONES	49													067
069	KEMPER		*												069
071	LAFAYETTE	5	*				X								071
073	LAMAR														073
075	LAUDERDALE	49	*												075
077	LAWRENCE	49													077
079	LEAKE	5													079
081	LEE	5													081
083	LEFLORE	5													083
085	LINCOLN	5													085
087	LOWNDES														087
089	MADISON	5													089
091	MARION	49													091
093	MARSHALL	5													093
095	MONROE														095
097	MONTGOMERY	5													097
099	NESHOBA														099
101	NEWTON	49													101
103	NOXUBEE														103
105	OKTIBBEHA														105
107	PANOLA	5													107
109	PEARL RIVER	49 50	*												109
111	PERRY	49													111
113	PIKE	5													113
115	PONTOTOC	5													115
117	PRENTISS	5													117
119	QUITMAN	5													119
121	RANKIN		*												121
123	SCOTT	49	*												123
125	SHARKEY	5													125
127	SIMPSON														127
129	SMITH	49													129
131	STONE	49 50													131
133	SUNFLOWER	5													133
135	TALLAHATCHIE	5	*												135
137	TATE	5	*												137
139	TIPPAH	5	*												139
141	TISHOMINGO	44													141
143	TUNICA	5	*												143
145	UNION	5													145
147	WALTHALL														147
149	WARREN	5 49													149
151	WASHINGTON	5													151

APPENDIX C (CONTINUED)

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--------------------------------------------- FIPS STATE NUMBER=28   STATE=MISSISSIPPI ---------------------------------------------

    FIPS_CO   COUNTY                  IMP    COAL   CU    G_T   AU    FE    MO    NI    O_S   PEAT   P    AG    U    FIPS_CC

                                       49
    153       WAYNE                    49                                                                            153
    155       WEBSTER                   5     *                       X                                              155
    157       WILKINSON                 5                                                                            157
                                       49
    159       WINSTON                         *                                                                      159
    161       YALOBUSHA                 5     *                                                                      161
    163       YAZOO                     5     *                                                                      163

--------------------------------------------- FIPS STATE NUMBER=29   STATE=MISSOURI ---------------------------------------------

    FIPS_CO   COUNTY                  IMP    COAL   CU    G_T   AU    FE    MO    NI    O_S   PEAT   P    AG    U    FIPS_CC

    001       ADAIR                           2                                                                      001
    003       ANDREW                    6     *                                                                      003
    005       ATCHISON                  6     *                                                                      005
    007       AUDRAIN                         2                                                                      007
    009       BARRY                                                                                                  009
    011       BARTON                          2                                                                      011
    013       BATES                           2                                                                      013
    015       BENTON                                              X                                              015
    017       BOLLINGER                                           *                                              017
    019       BOONE                           2                                                                      019
    021       BUCHANAN                  6     *                                                                      021
    023       BUTLER                    5                             *                                              023
    025       CALDWELL                        2                                                                      025
    027       CALLAWAY                        2                                                                      027
    029       CAMDEN                                              X                                              029
    031       CAPE GIRARDEAU           19                                                                            031
                                       66
                                       72
                                       77
    033       CARROLL                         2                                                                      033
    035       CARTER                                              *                                              035
    037       CASS                            2                                                                      037
    039       CEDAR                           2                                                                      039
    041       CHARITON                        2                                                                      041
    043       CHRISTIAN                                                                                              043
    045       CLARK                    19                                                                            045
                                       27
                                       66
                                       72
                                       77
    047       CLAY                      6     2                                                                      047
    049       CLINTON                   6     *                                                                      049
    051       COLE                                                                                                   051
    053       COOPER                                                                                                 053
    055       CRAWFORD                              X                 X                                   *          055
    057       DADE                            2                                                                      057
    059       DALLAS                                                                                                 059
    061       DAVIESS                   6     2                                                                      061
    063       DE KALB                   6     *                                                                      063
    065       DENT                                                    X                                   X          065
    067       DOUGLAS                                                 *                                              067
    069       DUNKLIN                   5                                                                            069
    071       FRANKLIN                              *                 X                                              071
    073       GASCONADE                                               *                                              073
    075       GENTRY                    6     *                                                                      075
    077       GREENE                                                  *                                              077
    079       GRUNDY                          2                                                                      079
    081       HARRISON                  6     2                                                                      081
    083       HENRY                           2                       *                                              083
    085       HICKORY                                                                                                085
    087       HOLT                      6     *                                                                      087
    089       HOWARD                          2                                                                      089
    091       HOWELL                                                  X                                              091
    093       IRON                                  X                 X                                              093
    095       JACKSON                                                                                                095
    097       JASPER                          2                                                                      097
    099       JEFFERSON                19                                                                            099
                                       66
                                       72
                                       77
    101       JOHNSON                         2                                                                      101
    103       KNOX                                                                                                   103
    105       LACLEDE                                                                                                105
    107       LAFAYETTE                       2                                                                      107
    109       LAWRENCE                                                                                               109
    111       LEWIS                    19                                                                            111
                                       27
                                       66
                                       72
                                       77
    113       LINCOLN                  19                                                                            113
                                       27
                                       66
                                       72
                                       77
    115       LINN                            2                                                                      115
    117       LIVINGSTON                      2                                                                      117
    119       MCDONALD                                                                                               119
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APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=29 STATE=MISSOURI --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
121	MACON		2												121
123	MADISON			X			*		X				X		123
125	MARIES														125
127	MARION	19 27 66 72 77													127
129	MERCER		2												129
131	MILLER						*								131
133	MISSISSIPPI	5 19 66 72 77													133
135	MONITEAU														135
137	MONROE		2												137
139	MONTGOMERY		2												139
141	MORGAN						*								141
143	NEW MADRID	5													143
145	NEWTON														145
147	NODAWAY	6	2												147
149	OREGON						X								149
151	OSAGE						X								151
153	OZARK						*								153
155	PEMISCOT	5													155
157	PERRY	19 66 72 77													157
159	PETTIS		2												159
161	PHELPS						X								161
163	PIKE	19 27 66 72 77													163
165	PLATTE	6	*												165
167	POLK						*								167
169	PULASKI						*								169
171	PUTNAM		2												171
173	RALLS	19 27 66 72 77	2												173
175	RANDOLPH		2												175
177	RAY		2												177
179	REYNOLDS			*			*						*		179
181	RIPLEY						*								181
183	ST CHARLES	19 27 66 72 77													183
185	ST CLAIR		2				*								185
187	ST FRANCOIS			*			X						X		187
189	ST LOUIS	19 27 66 72 77													189
193	STE GENEVIEVE	19 66 72 77		*			X						X		193
195	SALINE		2												195
197	SCHUYLER		2												197
199	SCOTLAND														199
201	SCOTT	5 19 66 72 77													201
203	SHANNON			*			*								203
205	SHELBY														205
207	STODDARD	5													207
209	STONE														209
211	SULLIVAN		2												211
213	TANEY														213
215	TEXAS						*								215
217	VERNON		2												217
219	WARREN														219
221	WASHINGTON			X			X						*		221
223	WAYNE						X								223
225	WEBSTER														225
227	WORTH	6	2												227
229	WRIGHT														229

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=30 STATE=MONTANA --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	BEAVERHEAD			X	3	X	X	X				X	X		C01
003	BIG HORN	25 63	3												C03
005	BLAINE	6	2												C05
007	BROADWATER		1	X		X	X	X					X		C07
009	CARBON	25 63	2											X	C09
011	CARTER	6 25 63												X	C11
013	CASCADE		2	X		X		X					X		C13
015	CHOUTEAU	6	1												C15
017	CUSTER	6 25 63	3												C17
019	DANIELS	6 25													C19
021	DAWSON	6 25 63	3												C21
023	DEER LODGE				2	X	X						X		C23
025	FALLON	6 25 63	2												C25
027	FERGUS		2			X							X		C27
029	FLATHEAD	69											X		C29
031	GALLATIN	63			3										C31
033	GARFIELD	6 25 63	2												C33
035	GLACIER		2				X								C35
037	GOLDEN VALLEY	63													C37
039	GRANITE			X		X							X		C39
041	HILL	6													C41
043	JEFFERSON			X	2	X							X		C43
045	JUDITH BASIN		2				X								C45
047	LAKE	69													C47
049	LEWIS AND CLARK	69		X	2	X							X		C49
051	LIBERTY	6													C51
053	LINCOLN	69		X		X							X		C53
055	MCCONE	6 25 63	3												C55
057	MADISON			X	2	X	X	X					X		C57
059	MEAGHER	63	1				X						X		C59
061	MINERAL	69				X							X		061
063	MISSOULA	69				X									C63
065	MUSSELSHELL	25 63	3												C65
067	PARK	63		X	3	X		X					X		C67
069	PETROLEUM	25													C69
071	PHILLIPS	6			3	X							X		C71
073	PONDERA														C73
075	POWDER RIVER	6 25 63	3												C75
077	POWELL	69				X		X					X		C77
079	PRAIRIE	6 25 63	2												C79
081	RAVALLI					X							X		C81
083	RICHLAND	6 25 63	2												C83
085	ROOSEVELT	6 25	2												C85
087	ROSEBUD	6 25 63	3												C87
089	SANDERS	69			3								X		C89
091	SHERIDAN	6 25	2												C91
093	SILVER BOW			X	2	X							X		C93
095	STILLWATER	63	1	X		X	X		X				X		C95
097	SWEET GRASS	63													C97
099	TETON						X								099
101	TOOLE	6													101
103	TREASURE	25 63	3												103
105	VALLEY	6 25													105
107	WHEATLAND														107
109	WIBAUX	6 25 63	2												109
111	YELLOWSTONE	25 63	2												111

APPENDIX C (CONTINUED)

FIPS STATE NUMBER=31 STATE=NEBRASKA

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAMS	6 12													001
003	ANTELOPE	6 52													003
005	ARTHUR	6 52													005
007	BANNER	52													007
009	BLAINE	6 52													009
011	BOONE	6 52													011
013	BOX BUTTE	6 12 52													013
015	BOYD	6 12 52													015
017	BROWN	6 12 52													017
019	BUFFALO	6 12													019
021	BURT	6													021
023	BUTLER	6													023
025	CASS	6													025
027	CEDAR	6													027
029	CHASE														029
031	CHERRY	6 12 52													031
033	CHEYENNE														033
035	CLAY	6													035
037	COLFAX	6													037
039	CUMING	6													039
041	CUSTER	6 52													041
043	DAKOTA	6													043
045	DAWES	6 12 52													045
047	DAWSON	6 12 52													047
049	DEUEL														049
051	DIXON	6													051
053	DODGE	6													053
055	DOUGLAS	6													055
057	DUNDY														057
059	FILLMORE	6													059
061	FRANKLIN	6 12													061
063	FRONTIER	6 12													063
065	FURNAS	6 12													065
067	GAGE	6													067
069	GARDEN	52													069
071	GARFIELD	6 52													071
073	GOSPER	6 12													073
075	GRANT	6 52													075
077	GREELEY	6 52													077
079	HALL	6 12													079
081	HAMILTON	6 12													081
083	HARLAN	6 12													083
085	HAYES														085
087	HITCHCOCK														087
089	HOLT	6 12 52													089
091	HOOKER	6 52													091
093	HOWARD	6 12													093
095	JEFFERSON	6													095
097	JOHNSON	6													097
099	KEARNEY	6 12													099
101	KEITH	12 52													101
103	KEYA PAHA	6 12 52													103
105	KIMBALL	25													105
107	KNOX	6 12													107

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=31 STATE=NEBRASKA --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
109	LANCASTER	6													109
111	LINCOLN	6													111
		12													
		52													
113	LOGAN	6													113
		52													
115	LOUP	6													115
		52													
117	MCPHERSON	6													117
		52													
119	MADISON	6													119
121	MERRICK	6													121
		12													
123	MORRILL	52													123
125	NANCE	6													125
		12													
127	NEMAHA	6													127
129	NUCKOLLS	6													129
131	OTOE	6													131
133	PAWNEE	6													133
135	PERKINS	12													135
137	PHELPS	6													137
		12													
139	PIERCE	6													139
141	PLATTE	6													141
		12													
143	POLK	6													143
		12													
145	RED WILLOW	6													145
147	RICHARDSON	6													147
149	ROCK	6													149
		12													
		52													
151	SALINE	6													151
153	SARPY	6													153
155	SAUNDERS	6													155
157	SCOTTS BLUFF	52												X	157
159	SEWARD	6													159
161	SHERIDAN	6													161
		12													
		52													
163	SHERMAN	6													163
		12													
165	SIOUX	6												X	165
		12													
		52													
167	STANTON	6													167
169	THAYER	6													169
171	THOMAS	6													171
		52													
173	THURSTON	6													173
175	VALLEY	6													175
		52													
177	WASHINGTON	6													177
179	WAYNE	6													179
181	WEBSTER	6													181
183	WHEELER	6													183
185	YORK	6													185
		12													

-- FIPS STATE NUMBER=32 STATE=NEVADA --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	CHURCHILL	53			1	X			X				X		C01
003	CLARK	13		X	3	X			X				X		C03
		28													
005	DOUGLAS				3		X							X	C05
007	ELKO			X	1	X		X					X	X	C07
009	ESMERALDA			X	3	X							X		C09
011	EUREKA			X	1	X	X		X				X		C11
013	HUMBOLDT				1	X	X	X					X	X	C13
015	LANDER			X	2	X	X						X	X	C15
017	LINCOLN	13		X		X	X						X		C17
019	LYON	53		X	2	X	X						X		C19
021	MINERAL			X	3	X							X		C21
023	NYE	13			2	X	X						X	X	C23
027	PERSHING			X	1	X	X	X					X		C27
029	STOREY	53			1	X	X						X		C29
		54													
031	WASHOE	53			1	X							X	X	C31
		54													
033	WHITE PINE	13		X	2	X							X		C33
510	CARSON CITY				3									3	510

APPENDIX C (CONTINUED)

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------------------------- FIPS STATE NUMBER=33   STATE=NEW HAMPSHIRE -------------------------

FIPS_CO  COUNTY        IRP COAL CU G_T AU FE MO NI O_S PEAT P AG U FIPS_CO

001      BELKNAP       36                                          001
                       76
003      CARROLL       36                                          003
                       76
005      CHESHIRE      26                                          005
                       36
                       76
007      COOS          26       X      X                      X    007
                       36
                       76
009      GRAFTON       26                                          009
                       36
                       76
011      HILLSBOROUGH  26                                          011
                       36
                       76
013      MERRIMACK     26                                          013
                       36
                       76
015      ROCKINGHAM    24                                          015
                       26
                       36
                       76
017      STRAFFORD     36                                          017
                       76
019      SULLIVAN      26                                          019
                       36
                       76

------------------------- FIPS STATE NUMBER=34   STATE=NEW JERSEY -------------------------

FIPS_CO  COUNTY        IRP COAL CU G_T AU FE MO NI O_S PEAT P AG U FIPS_CO

001      ATLANTIC      19           1                              001
                       24
                       51
                       76
003      BERGEN        22       X                                  003
                       51
005      BURLINGTON    51           1                              005
                       76
007      CAMDEN        51                                          007
                       76
009      CAPE MAY      19                                          009
                       24
                       51
                       76
011      CUMBERLAND    19                                          011
                       51
                       76
013      ESSEX         22                                          013
                       51
015      GLOUCESTER    19                                          015
                       51
                       76
017      HUDSON        51                                          017
019      HUNTERDON     51                                          019
                       76
021      MERCER        51                                          021
                       76
023      MIDDLESEX     22                                          023
                       51
025      MONMOUTH      22           1                              025
                       24
                       51
                       76
027      MORRIS        51                 X                        027
                       76
029      OCEAN         22           1                              029
                       24
                       51
                       76
031      PASSAIC       51                 X                        031
                       76
033      SALEM         19                                          033
                       51
                       76
035      SOMERSET      51                                          035
037      SUSSEX        51                 X  X                     037
                       76
039      UNION         22                                          039
                       51
041      WARREN        51       X         X                        041
                       76
```

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=35 STATE=NEW MEXICO --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
001	BERNALILLO	57			*	X		X						X	001
003	CATRON	13 28			2	X		X					X	X	003
005	CHAVES	57 67													005
007	COLFAX	59	3			X		X							007
009	CURRY	59 67													009
011	DE BACA	57 67													011
013	DONA ANA	57		X	2	X	X	X					X		013
015	EDDY	57 60 67													015
017	GRANT	13 28		X	3	X	X	X	X				X		017
019	GUADALUPE	57 67		X						2					019
021	HARDING	59													021
023	HIDALGO	13 28		X	2	X		X					X		023
025	LEA	67													025
027	LINCOLN	67	1			X	X	X							027
028	LOS ALAMOS	57													028
029	LUNA				*			X					X		029
031	MCKINLEY	13 25	2		3			X						X	031
033	MORA														033
035	OTERO	67		X	3	X	X	X							035
037	QUAY	59 67													037
039	RIO ARRIBA	13 28 57	1	X	3	X		X						X	039
041	ROOSEVELT	59 67													041
043	SANDOVAL	13 25 57	2		1	X							X	X	043
045	SAN JUAN	13 25 28	3		3									X	045
047	SAN MIGUEL	57 59		X	*	X		X					X		047
049	SANTA FE	57	2	X		X		X					X	X	049
051	SIERRA	57		X	*	X	X	X					X		051
053	SOCORRO	57 60	2	X	2	X	X	X					X	X	053
055	TAOS	57			3			X							055
057	TORRANCE	67													057
059	UNION	59													059
061	VALENCIA	13 57	1		*			X						X	061

-- FIPS STATE NUMBER=36 STATE=NEW YORK --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
001	ALBANY	22 51 76													001
003	ALLEGANY	11 76													003
005	BRONX	22 51													005
007	BROOME	14 51 76			1										007
009	CATTARAUGUS	11 76									2				009
011	CAYUGA	11 76					X								011
013	CHAUTAUQUA	11 76													013
015	CHEMUNG	11 51 76			1										015
017	CHENANGO	14 51 76													017
019	CLINTON	11 76					X								019
021	COLUMBIA	22 51 76													021
023	CORTLAND	11 51 76													023
025	DELAWARE	14 51 76													025

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=36 STATE=NEW YORK --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
027	DUTCHESS	22 51 76					X								027
029	ERIE	11 76													029
031	ESSEX	11 76					X								031
033	FRANKLIN	11 76					X								033
035	FULTON	51 76													035
037	GENESEE	11 76													037
039	GREENE	22 51 76													039
041	HAMILTON	11 76													041
043	HERKIMER	11 51 76													043
045	JEFFERSON	11 76					X								045
047	KINGS	22 24 51													047
049	LEWIS	11 76													049
051	LIVINGSTON	11 76													051
053	MADISON	11 51 76													053
055	MONROE	11 76													055
057	MONTGOMERY	51 76													057
059	NASSAU	22 24 36													059
061	NEW YORK	22 51													061
063	NIAGARA	11 76													063
065	ONEIDA	11 76													065
067	ONONDAGA	11 76													067
069	ONTARIO	11 76													069
071	ORANGE	22 51 76					X								071
073	ORLEANS	11 76													073
075	OSWEGO	11 76													075
077	OTSEGO	14 51 76													077
079	PUTNAM	22 51 76		X			X								079
081	QUEENS	22 24 51													081
083	RENSSELAER	22 51 76													083
085	RICHMOND	22 51													085
087	ROCKLAND	22 51 76													087
089	ST LAWRENCE	11 76					X						X		089
091	SARATOGA	51 76													091
093	SCHENECTADY	51 76													093
095	SCHOHARIE	51 76													095
097	SCHUYLER	11 51 76			1										097
099	SENECA	11 76													099
101	STEUBEN	11 51 76			1										101
103	SUFFOLK	22 24													103

APPENDIX C (CONTINUED)

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------------------------------------------- FIPS STATE NUMBER=36   STATE=NEW YORK -------------------------------------------

    FIPS_CO   COUNTY                IMP   COAL    CU    G_T    AU    FE    MO    NI    O_S    PEAT   P    AG    U    FIPS_CC

                                    36
    105       SULLIVAN              51            X                                                                  105
                                    76
    107       TIOGA                 11                   1                                                           107
                                    51
                                    76
    109       TOMPKINS              11                   1                                                           109
                                    51
                                    76
    111       ULSTER                22                                                                               111
                                    51
                                    76
    113       WARREN                51                                                                               113
                                    76
    115       WASHINGTON            22                                                                               115
                                    51
                                    76
    117       WAYNE                 11                               X                                               117
                                    76
    119       WESTCHESTER           22            X                  X                                               119
                                    51
                                    76
    121       WYOMING               11                                                                               121
                                    76
    123       YATES                 11                                                                               123
                                    76

------------------------------------------- FIPS STATE NUMBER=37   STATE=NORTH CAROLINA -------------------------------------------

    FIPS_CO   COUNTY                IMP   COAL    CU    G_T    AU    FE    MO    NI    O_S    PEAT   P    AG    U    FIPS_CC

    001       ALAMANCE                                                                                               001
    003       ALEXANDER                                                                                              003
    005       ALLEGHANY                                                                                              005
    007       ANSON                                                                                                  007
    009       ASHE                                X                  X                                    X          009
    011       AVERY                                                  X                                               011
    013       BEAUFORT              29                                                         1     X               013
                                    32
                                    38
                                    49
    015       BERTIE                29                                                         2                     015
                                    32
                                    38
                                    49
    017       BLADEN                49                                                                               017
    019       BRUNSWICK             24                   1                                     2                     019
                                    29
                                    32
                                    38
                                    49
    021       BUNCOMBE                                                                                               021
    023       BURKE                                            X                                                     023
    025       CABARRUS                                         X                                                     025
    027       CALDWELL                                                                                               027
    029       CAMDEN                19                                                         1                     029
                                    29
                                    32
                                    38
                                    49
    031       CARTERET              24                                                         2                     031
                                    29
                                    32
                                    38
                                    49
    033       CASWELL                                                                                                033
    035       CATAWBA                                                X                                               035
    037       CHATHAM                     2                                                                          037
    039       CHEROKEE              44                               X                                               039
    041       CHOWAN                29                                                         1                     041
                                    32
                                    38
                                    49
    043       CLAY                                                   X                                               043
    045       CLEVELAND                           X            X                                                     045
    047       COLUMBUS              38                   1                                     2                     047
                                    49
    049       CRAVEN                29                   1                                     2                     049
                                    32
                                    38
                                    49
    051       CUMBERLAND            49                                                                               051
    053       CURRITUCK             19                                                         1                     053
                                    24
                                    29
                                    32
                                    38
                                    49
    055       DARE                  24                                                         1                     055
                                    29
                                    32
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APPENDIX C (CONTINUED)

FIPS STATE NUMBER=37 STATE=NORTH CAROLINA

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		38													
		49													
057	DAVIDSON					X							X		057
059	DAVIE														059
061	DUPLIN				1						2				061
063	DURHAM														063
065	EDGECOMBE														065
067	FORSYTH														067
069	FRANKLIN					X									069
071	GASTON					X									071
073	GATES	29									1				073
		32													
		38													
075	GRAHAM	44													075
077	GRANVILLE						X								077
079	GREENE				1										079
081	GUILFORD			X		X									081
083	HALIFAX							X							083
085	HARNETT														085
087	HAYWOOD	49													087
089	HENDERSON														089
091	HERTFORD	29									2				091
		32													
		38													
		49													
093	HOKE														093
095	HYDE	24									2				095
		29													
		32													
		38													
		49													
097	IREDELL														097
099	JACKSON			X					X						099
101	JOHNSTON														101
103	JONES	29			1						2				103
		32													
		38													
		49													
105	LEE		2												105
107	LENOIR	49			1						2				107
109	LINCOLN						X								109
111	MCDOWELL														111
113	MACON														113
115	MADISON	44						X							115
117	MARTIN	29													117
		32													
		49													
119	MECKLENBURG					X									119
121	MITCHELL														121
123	MONTGOMERY					X									123
125	MOORE														125
127	NASH														127
129	NEW HANOVER	24									2				129
		29													
		32													
		38													
		49													
131	NORTHAMPTON														131
133	ONSLOW	24			1						2				133
		29													
		32													
		38													
		49													
135	ORANGE														135
137	PAMLICO	24									2				137
		29													
		32													
		38													
		49													
139	PASQUOTANK	29									1				139
		32													
		38													
		49													
141	PENDER	24									2				141
		29													
		32													
		38													
		49													
143	PERQUIMANS	29									1				143
		32													
		38													
		49													
145	PERSON			X											145
147	PITT	29			1										147
		32													
		38													
		49													
149	POLK														149
151	RANDOLPH					X									151
153	RICHMOND														153
155	ROBESON	49													155
157	ROCKINGHAM														157

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=37 STATE=NORTH CAROLINA ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
159	ROWAN			X		X							X		159
161	RUTHERFORD														161
163	SAMPSON														163
165	SCOTLAND														165
167	STANLY					X									167
169	STOKES														169
171	SURRY														171
173	SWAIN	44		X											173
175	TRANSYLVANIA					X									175
177	TYRRELL	29 32 38 49									1				177
179	UNION					X									179
181	VANCE														181
183	WAKE														183
185	WARREN														185
187	WASHINGTON	29 32 38 49									1				187
189	WATAUGA														189
191	WAYNE				1										191
193	WILKES														193
195	WILSON														195
197	YADKIN														197
199	YANCEY							X							199

--- FIPS STATE NUMBER=38 STATE=NORTH DAKOTA ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
001	ADAMS	6 25	2												001
003	BARNES	6 70													003
005	BENSON	6													005
007	BILLINGS	6 25	3					X						X	007
009	BOTTINEAU	6													009
011	BOWMAN	6 25	2											X	011
013	BURKE	6 25	2												013
015	BURLEIGH	6 25	2												015
017	CASS	6													017
019	CAVALIER	6													019
021	DICKEY	6 70													021
023	DIVIDE	6 25	2												023
025	DUNN	6 25	3												025
027	EDDY	6 70													027
029	EMMONS	6													029
031	FOSTER	6 70													031
033	GOLDEN VALLEY	6 25 63	2												033
035	GRAND FORKS	6 71													035
037	GRANT	6 25	2												037
039	GRIGGS	6													039
041	HETTINGER	6 25	2												041
043	KIDDER	6 70													043
045	LA MOURE	6 70													045
047	LOGAN	6 70													047
049	MCHENRY	6 25	2												049
051	MCINTOSH	6 70													051
053	MCKENZIE	6 25 63	3												053
055	MCLEAN	6 25	3												055
057	MERCER	6 25	3												057
059	MORTON	6 25	2												059
061	MOUNTRAIL	6 25	2												061
063	NELSON	6													063

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=38 STATE=NORTH DAKOTA --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
065	OLIVER	6 25	2												065
067	PEMBINA	6 71													067
069	PIERCE	6													069
071	RAMSEY	6													071
073	RANSOM	6 70													073
075	RENVILLE	6 25	1												075
077	RICHLAND	6													077
079	ROLETTE	6													079
081	SARGENT	6 70													081
083	SHERIDAN	6 25													083
085	SIOUX	6 25													085
087	SLOPE	6 25	3											X	087
089	STARK	6 25	3												089
091	STEELE	6													091
093	STUTSMAN	6 70													093
095	TOWNER	6													095
097	TRAILL	6 71													097
099	WALSH	6 71													099
101	WARD	6 25	2												101
103	WELLS	6 70													103
105	WILLIAMS	6 25	3												105

-- FIPS STATE NUMBER=39 STATE=OHIO --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAMS	19 65 77								1					001
003	ALLEN	11 77													003
005	ASHLAND	11 77													005
007	ASHTABULA	11 61 73 77								1					007
009	ATHENS	77	3												009
011	AUGLAIZE	11 77													011
013	BELMONT	77	3												013
015	BROWN	19 65 77													015
017	BUTLER	77													017
019	CARROLL	77	2												019
021	CHAMPAIGN	77													021
023	CLARK	77													023
025	CLERMONT	19 77													025
027	CLINTON	77													027
029	COLUMBIANA	77	2												029
031	COSHOCTON	77	2												031
033	CRAWFORD	11 77								1					033
035	CUYAHOGA	11 61 73 77								1					035
037	DARKE	77													037
039	DEFIANCE	11 77								1					039
041	DELAWARE	77								1					041
043	ERIE	11 61 73 77								1					043
045	FAIRFIELD	77													045
047	FAYETTE	77													047
049	FRANKLIN	77								1					049
051	FULTON	11 77								1					051
053	GALLIA	77	2												053
055	GEAUGA	11 77								1					055
057	GREENE	77													057

-- FIPS STATE NUMBER=39 STATE=OHIO --

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
059	GUERNSEY	77	3												059
061	HAMILTON	19 77													061
063	HANCOCK	11 77													063
065	HARDIN	11 77													065
067	HARRISON	77	3												067
069	HENRY	11 77								1					069
071	HIGHLAND	77								1					071
073	HOCKING	77	2												073
075	HOLMES	77	2												075
077	HURON	11 77								1					077
079	JACKSON	77	2												079
081	JEFFERSON	77	3												081
083	KNOX	77								1					083
085	LAKE	11 61 73 77													085
087	LAWRENCE	77	2												087
089	LICKING	77													089
091	LOGAN	77								1					091
093	LORAIN	11 61 73 77								1					093
095	LUCAS	11 61 73 77								1					095
097	MADISON	77													097
099	MAHONING	77	2												099
101	MARION	77								1					101
103	MEDINA	11 77													103
105	MEIGS	77	2												105
107	MERCER	11 77													107
109	MIAMI	77													109
111	MONROE	77	2				X								111
113	MONTGOMERY	77													113
115	MORGAN	77	2												115
117	MORROW	77								1					117
119	MUSKINGUM	77	2												119
121	NOBLE	77	2												121
123	OTTAWA	61 73 77													123
125	PAULDING	11 77													125
127	PERRY	77	2												127
129	PICKAWAY	77								1					129
131	PIKE	77								1					131
133	PORTAGE	11 77													133
135	PREBLE	77													135
137	PUTNAM	11 77													137
139	RICHLAND	11 77													139
141	ROSS	77								1					141
143	SANDUSKY	11 73 77													143
145	SCIOTO	65 77	1							1					145
147	SENECA	11 77													147
149	SHELBY	11 77													149
151	STARK	11 77	2												151
153	SUMMIT	11 77								1					153
155	TRUMBULL	11 77								1					155
157	TUSCARAWAS	77	3												157
159	UNION	77													159
161	VAN WERT	11 77													161
163	VINTON	77	2												163
165	WARREN	77													165
167	WASHINGTON	77	2				X								167
169	WAYNE	77	1												169
171	WILLIAMS	11 77								1					171
173	WOOD	11 77													173
175	WYANDOT	11													175

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=39 STATE=OHIO ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
		77													

--- FIPS STATE NUMBER=40 STATE=OKLAHOMA ---

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
001	ADAIR	19								1					001
003	ALFALFA	19													003
005	ATOKA	19	2												005
007	BEAVER	19 59													007
009	BECKHAM	19 59													009
011	BLAINE	19													011
013	BRYAN	19													013
015	CADDO	19													015
017	CANADIAN	19													017
019	CARTER	19								1					019
021	CHEROKEE	19								1					021
023	CHOCTAW	19													023
025	CIMARRON	19 59													025
027	CLEVELAND	19													027
029	COAL	19	2							1					029
031	COMANCHE	19					X								031
033	COTTON	19													033
035	CRAIG	19	2												035
037	CREEK	19													037
039	CUSTER	19 59													039
041	DELAWARE	19								1					041
043	DEWEY	19 59													043
045	ELLIS	19 59													045
047	GARFIELD	19													047
049	GARVIN	19													049
051	GRADY	19													051
053	GRANT	19													053
055	GREER	19 59		X											055
057	HARMON	19 59													057
059	HARPER	19 59													059
061	HASKELL	19	2												061
063	HUGHES	19													063
065	JACKSON	19 59		X											065
067	JEFFERSON	19													067
069	JOHNSTON	19								1					069
071	KAY	19													071
073	KINGFISHER	19													073
075	KIOWA	19													075
077	LATIMER	19	2												077
079	LE FLORE	19	2												079
081	LINCOLN	19													081
083	LOGAN	19													083
085	LOVE	19													085
087	MCCLAIN	19													087
089	MCCURTAIN	19													089
091	MCINTOSH	19	1												091
093	MAJOR	19													093
095	MARSHALL	19													095
097	MAYES	19								1					097
099	MURRAY	19					X			1					099
101	MUSKOGEE	19	1												101
103	NOBLE	19													103
105	NOWATA	19	2												105
107	OKFUSKEE	19	1												107
109	OKLAHOMA	19													109
111	OKMULGEE	19	2												111
113	OSAGE	19													113
115	OTTAWA	19													115
117	PAWNEE	19													117
119	PAYNE	19													119
121	PITTSBURG	19	2												121
123	PONTOTOC	19					X			1					123
125	POTTAWATOMIE	19													125
127	PUSHMATAHA	19													127
129	ROGER MILLS	19 59													129
131	ROGERS	19	2												131
133	SEMINOLE	19													133
135	SEQUOYAH	19	1							1					135
137	STEPHENS	19													137
139	TEXAS	19 59													139
141	TILLMAN	19													141
143	TULSA	19	1												143
145	WAGONER	19	1												145

APPENDIX C (CONTINUED)

FIPS STATE NUMBER=40 STATE=OKLAHOMA

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
147	WASHINGTON	19													147
149	WASHITA	19													149
151	WOODS	19 59													151
153	WOODWARD	19 59													153

FIPS STATE NUMBER=41 STATE=OREGON

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	BAKER	1		X	2	X							X		001
003	BENTON														003
005	CLACKAMAS				2										005
007	CLATSOP	31													007
009	COLUMBIA						X								009
011	COOS	31	1				X								011
013	CROOK	1													013
015	CURRY	18 31							X						015
017	DESCHUTES				1										017
019	DOUGLAS	31			2				X				X		019
021	GILLIAM	1													021
023	GRANT	1			2	X							X		023
025	HARNEY	58			1										025
027	HOOD RIVER	1			2										027
029	JACKSON	18				X			X						029
031	JEFFERSON	1			2								X		031
033	JOSEPHINE			X		X			X						033
035	KLAMATH	18 35			2										035
037	LAKE	18			1									X	037
039	LANE	31			2	X							X		039
041	LINCOLN	31													041
043	LINN														043
045	MALHEUR				1	X								X	045
047	MARION				2										047
049	MORROW	1													049
051	MULTNOMAH														051
053	POLK														053
055	SHERMAN	1													055
057	TILLAMOOK	31													057
059	UMATILLA	1			3										059
061	UNION	1			2										061
063	WALLOWA	1													063
065	WASCO	1			2										065
067	WASHINGTON														067
069	WHEELER	1													069
071	YAMHILL														071

FIPS STATE NUMBER=42 STATE=PENNSYLVANIA

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAMS	51 76													001
003	ALLEGHENY	76	2												003
005	ARMSTRONG	76	3												005
007	BEAVER	76	2												007
009	BEDFORD	51 76	2		1		X								009
011	BERKS	14 51 76		X		X	X						X		011
013	BLAIR	51 76	2		1		X								013
015	BRADFORD	51 76	2		1										015
017	BUCKS	51 76													017
019	BUTLER	76	3				X								019
021	CAMBRIA	51 76	3		1										021
023	CAMERON	76	2		1										023
025	CARBON	51 76	2												025
027	CENTRE	51 76	2				X								027
029	CHESTER	51 76													029
031	CLARION	76	2												031
033	CLEARFIELD	51 76	3		1										033
035	CLINTON	14 51 76	2		1										035
037	COLUMBIA	51 76	2												037
039	CRAWFORD	11 76													039

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=42 STATE=PENNSYLVANIA ---

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
041	CUMBERLAND	51													041
		76													
043	DAUPHIN	51	2												043
		76													
045	DELAWARE	51													045
		76													
047	ELK	76	2		1										047
049	ERIE	11													049
		76													
051	FAYETTE	76	3		1		X								051
053	FOREST	76													053
055	FRANKLIN	51													055
		76													
057	FULTON	51	2												057
		76													
059	GREENE	76	3												059
061	HUNTINGDON	51	2												061
		76													
063	INDIANA	76	3		1										063
065	JEFFERSON	76	2		1										065
067	JUNIATA	51					X								067
		76													
069	LACKAWANNA	51	2												069
		76													
071	LANCASTER	14		X					X						071
		51													
		76													
073	LAWRENCE	76	2												073
075	LEBANON	14	2	X		X	X						X		075
		51													
		76													
077	LEHIGH	51					X								077
		76													
079	LUZERNE	14	2												079
		51													
		76													
081	LYCOMING	14	2		1										081
		51													
		76													
083	MCKEAN	76	2												083
085	MERCER	76	2												085
087	MIFFLIN	51													087
		76													
089	MONROE	51													089
		76													
091	MONTGOMERY	51													091
		76													
093	MONTOUR	14													093
		51													
		76													
095	NORTHAMPTON	51													095
		76													
097	NORTHUMBERLAND	14	2												097
		51													
		76													
099	PERRY	51													099
		76													
101	PHILADELPHIA	51													101
		76													
103	PIKE	51													103
		76													
105	POTTER	11			1										105
		51													
		76													
107	SCHUYLKILL	14	3												107
		51													
		76													
109	SNYDER	51													109
		76													
111	SOMERSET	51	3		1										111
		76													
113	SULLIVAN	51	2		1										113
		76													
115	SUSQUEHANNA	14			1										115
		51													
		76													
117	TIOGA	51	2		1										117
		76													
119	UNION	14													119
		51													
		76													
121	VENANGO	76	2												121
123	WARREN	76													123
125	WASHINGTON	76	3												125
127	WAYNE	51	1												127
		76													
129	WESTMORELAND	76	2		1										129
131	WYOMING	14			1										131
		51													
		76													
133	YORK	51					X								133
		76													

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=44 STATE=RHODE ISLAND --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	BRISTOL	36													C01
003	KENT	36													C03
005	NEWPORT	24													C05
		36													
007	PROVIDENCE	36					X								C07
009	WASHINGTON	24													C09
		26													
		36													

-- FIPS STATE NUMBER=45 STATE=SOUTH CAROLINA --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ABBEVILLE														C01
003	AIKEN														003
005	ALLENDALE	49			1										C05
		55													
007	ANDERSON														C07
009	BAMBERG	49			1										C09
011	BARNWELL	55			1										C11
013	BEAUFORT	24			1						2				C13
		29													
		32													
		38													
		55													
015	BERKELEY	29			1						2				C15
		32													
		38													
		49													
017	CALHOUN				1										C17
019	CHARLESTON	24			1						2				C19
		29													
		32													
		38													
		49													
021	CHEROKEE														C21
023	CHESTER														C23
025	CHESTERFIELD	49				X									C25
027	CLARENDON	49													C27
029	COLLETON	24			1						2				C29
		29													
		32													
		38													
		49													
031	DARLINGTON	49													C31
033	DILLON	49													C33
035	DORCHESTER	29			1						2				C35
		32													
		49													
037	EDGEFIELD														C37
039	FAIRFIELD														C39
041	FLORENCE	49													C41
043	GEORGETOWN	24			1						2				C43
		29													
		32													
		38													
		49													
045	GREENVILLE														C45
047	GREENWOOD														C47
049	HAMPTON	49			1						2				C49
		55													
051	HORRY	24			1						2				C51
		29													
		32													
		38													
		49													
053	JASPER	24									2				C53
		29													
		32													
		38													
		49													
		55													
055	KERSHAW														C55
057	LANCASTER					X		X							C57
059	LAURENS														C59
061	LEE														C61
063	LEXINGTON														C63
065	MCCORMICK					X									C65
067	MARION	49			1						2				C67
069	MARLBORO	49													C69
071	NEWBERRY														C71
073	OCONEE														C73
075	ORANGEBURG	49			1										075
077	PICKENS														C77
079	RICHLAND														C79
081	SALUDA														C81
083	SPARTANBURG														C83
085	SUMTER	49													C85
087	UNION														C87
089	WILLIAMSBURG	49													C89
091	YORK														C91

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=46 STATE=SOUTH DAKOTA --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
003	AURORA	6 70													003
005	BEADLE	6 70													005
007	BENNETT	6 52													007
009	BON HOMME	6 70													009
011	BROOKINGS	6													011
013	BROWN	6 70													013
015	BRULE	6													015
017	BUFFALO	6													017
019	BUTTE	6 25												X	019
021	CAMPBELL	6													021
023	CHARLES MIX	6													023
025	CLARK	6 70													025
027	CLAY	6													027
029	CODINGTON	6													029
031	CORSON	6	2												031
033	CUSTER	6												X	033
035	DAVISON	6 70													035
037	DAY	6 70													037
039	DEUEL	6													039
041	DEWEY	6	2												041
043	DOUGLAS	6 70													043
045	EDMUNDS	6 70													045
047	FALL RIVER	6						X						X	047
049	FAULK	6 70													049
051	GRANT	6													051
053	GREGORY	6			1										053
055	HAAKON	6													055
057	HAMLIN	6													057
059	HAND	6 70													059
061	HANSON	6 70													061
063	HARDING	6 25	2					X						X	063
065	HUGHES	6													065
067	HUTCHINSON	6 70													067
069	HYDE	6 70													069
071	JACKSON	6													071
073	JERAULD	6 70													073
075	JONES	6			1										075
077	KINGSBURY	6 70													077
079	LAKE	6													079
081	LAWRENCE	6				X	X						X	X	081
083	LINCOLN	6													083
085	LYMAN	6			1										085
087	MCCOOK	6 70													087
089	MCPHERSON	6 70													089
091	MARSHALL	6 70													091
093	MEADE	6												X	093
095	MELLETTE	6													095
097	MINER	6 70													097
099	MINNEHAHA	6													099
101	MOODY	6													101
103	PENNINGTON	6				X	X	X						X	103
105	PERKINS	6 25	2											X	105
107	POTTER	6 70													107
109	ROBERTS	6													109
111	SANBORN	6 70													111
113	SHANNON	6 52													113
115	SPINK	6 70													115
117	STANLEY	6													117
119	SULLY	6 70													119
121	TODD	6 52													121
123	TRIPP	6													123
125	TURNER	6													125

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=46 STATE=SOUTH DAKOTA ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		70													
127	UNION	6													127
129	WALWORTH	6													129
131	WASHABAUGH	6													131
135	YANKTON	6													135
		70													
137	ZIEBACH	6	1												137

--- FIPS STATE NUMBER=47 STATE=TENNESSEE ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ANDERSON	44	2							1					001
		65													
003	BEDFORD	44													003
005	BENTON	44								1					005
007	BLEDSOE	44	2							1					007
		65													
009	BLOUNT	44								1					009
		65													
011	BRADLEY	44													011
		65													
013	CAMPBELL	44	2							1					013
		65													
015	CANNON	44								1					015
017	CARROLL	5													017
		44													
019	CARTER														019
021	CHEATHAM	44								1					021
023	CHESTER	5													023
		44													
025	CLAIBORNE	44	2				X			1					025
		65													
027	CLAY	44								1					027
029	COCKE	44													029
		65													
031	COFFEE	44								1					031
033	CROCKETT	5													033
035	CUMBERLAND	44	2				X								035
		65													
037	DAVIDSON	44								1					037
039	DECATUR	44								1					039
041	DE KALB	44								1					041
043	DICKSON	44													043
045	DYER	5													045
047	FAYETTE	5													047
049	FENTRESS	44	2												049
		65													
051	FRANKLIN	44								1					051
053	GIBSON	5													053
055	GILES	44								1		X			055
057	GRAINGER	44								1					057
		65													
059	GREENE	44													059
		65													
061	GRUNDY	44	1												061
063	HAMBLEN	44													063
		65													
065	HAMILTON	44	2				X			1					065
		65													
067	HANCOCK	65								1					067
069	HARDEMAN	5													069
071	HARDIN	44								1					071
073	HAWKINS	65								1					073
075	HAYWOOD	5													075
077	HENDERSON	5													077
		44													
079	HENRY	5													079
		44													
081	HICKMAN	44										X			081
083	HOUSTON	44													083
085	HUMPHREYS	44													085
087	JACKSON	44								1					087
089	JEFFERSON	44													089
		65													
091	JOHNSON														091
093	KNOX	44													093
		65													
095	LAKE	5													095
097	LAUDERDALE	5	*												097
099	LAWRENCE	44								1					099
101	LEWIS	44								1					101
103	LINCOLN	44								1					103
105	LOUDON	44													105
		65													
107	MCMINN	44													107
		65													
109	MCNAIRY	5													109
		44													
111	MACON	44								1					111
113	MADISON	5													113

APPENDIX C (CONTINUED)

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---------------------------------------------- FIPS STATE NUMBER=47   STATE=TENNESSEE ----------------------------------------------

    FIPS_CO   COUNTY                IMP    COAL  CU    G_T   AU   FE   MO   NI   O_S   PEAT   P   AG   U   FIPS_CC

                                    44
    115       MARION                44     2                      X               1                        115
                                    65
    117       MARSHALL              44                                                                     117
    119       MAURY                 44                                            1           X            119
    121       MEIGS                 44                            X                                        121
                                    65
    123       MONROE                44                                            1                        123
                                    65
    125       MONTGOMERY            44                                                                     125
    127       MOORE                 44                                            1                        127
    129       MORGAN                44     2                                                               129
                                    65
    131       OBION                  5                                                                     131
                                    44
    133       OVERTON               44     2                                      1                        133
    135       PERRY                 44                                            1                        135
    137       PICKETT               44     1                                                               137
                                    65
    139       POLK                  44           X           X    X                               X        139
                                    65
    141       PUTNAM                44     2                                      1                        141
    143       RHEA                  44     2                      X               1                        143
                                    65
    145       ROANE                 44     1                      X               1                        145
                                    65
    147       ROBERTSON             44                                                                     147
    149       RUTHERFORD            44                                                                     149
    151       SCOTT                 44     2                                                               151
                                    65
    153       SEQUATCHIE            44     2                                      1                        153
                                    65
    155       SEVIER                44                            X                                        155
                                    65
    157       SHELBY                 5     *                                                               157
    159       SMITH                 44                                                                     159
    161       STEWART               44                            X                                        161
    163       SULLIVAN              65                                                                     163
    165       SUMNER                44                                            1                        165
    167       TIPTON                 5     *                                                               167
    169       TROUSDALE             44                                                                     169
    171       UNICOI                                                                                       171
    173       UNION                 44                                                                     173
                                    65
    175       VAN BUREN             44     2                                                               175
    177       WARREN                44                                                                     177
    179       WASHINGTON            65                                                                     179
    181       WAYNE                 44                            X               1                        181
    183       WEAKLEY                5                                                                     183
    185       WHITE                 44     2                                      1                        185
    187       WILLIAMSON            44                                            1           X            187
    189       WILSON                44                                                                     189

---------------------------------------------- FIPS STATE NUMBER=48   STATE=TEXAS ----------------------------------------------

    FIPS_CO   COUNTY                IMP    COAL  CU    G_T   AU   FE   MO   NI   O_S   PEAT   P   AG   U   FIPS_CC

    001       ANDERSON                     2                                                               001
    003       ANDREWS                                                                                      003
    005       ANGELINA                     2                                                               005
    007       ARANSAS                4                                                                     007
                                    24
    009       ARCHER                                                                                       009
    011       ARMSTRONG             59                                                                     011
    013       ATASCOSA              67                  1                                              X   013
    015       AUSTIN                19                                                                 X   015
    017       BAILEY                59                                                                     017
    019       BANDERA               19                                                                     019
                                    67
    021       BASTROP               19     2            1                                                  021
                                    67
    023       BAYLOR                                                                                       023
    025       BEE                                                                                      X   025
    027       BELL                  19                  1                                                  027
                                    67
    029       BEXAR                 67     2            1                                                  029
    031       BLANCO                19                                                                     031
                                    67
    033       BORDEN                59                                                                     033
    035       BOSQUE                19                                                                     035
    037       BOWIE                 19     2                                                               037
    039       BRAZORIA               4                                                                     039
                                    24
    041       BRAZOS                19     2            1                                                  041
    043       BREWSTER              57                                                                     043
                                    60
                                    67
    045       BRISCOE               59                                                                     045
    047       BROOKS                                                                                   X   047
    049       BROWN                 19                                                                     049
    051       BURLESON              19     2            1                                                  051
```

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=48 STATE=TEXAS ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
053	BURNET	19 67													053
055	CALDWELL	19 67	2		1										055
057	CALHOUN	4 24													057
059	CALLAHAN	19													059
061	CAMERON	4 21 24													061
063	CAMP		2												063
065	CARSON	59													065
067	CASS		2				X								067
069	CASTRO	59													069
071	CHAMBERS	4 24													071
073	CHEROKEE		2				X								073
075	CHILDRESS	19 59													075
077	CLAY	19													077
079	COCHRAN	59													079
081	COKE	19													081
083	COLEMAN	19													083
085	COLLIN				1										085
087	COLLINGSWORTH	19 59													087
089	COLORADO													X	089
091	COMAL	19 67			1										091
093	COMANCHE	19													093
095	CONCHO	19 67													095
097	COOKE	19													097
099	CORYELL	19													099
101	COTTLE	59													101
103	CRANE	57 67													103
105	CROCKETT	57 67													105
107	CROSBY	59													107
109	CULBERSON	57		X				X					X		109
111	DALLAM	59													111
113	DALLAS				1										113
115	DAWSON	59													115
117	DEAF SMITH	59													117
119	DELTA				1										119
121	DENTON														121
123	DE WITT													X	123
125	DICKENS	59													125
127	DIMMIT														127
129	DONLEY	59													129
131	DUVAL							X						X	131
133	EASTLAND	19													133
135	ECTOR														135
137	EDWARDS	19 67													137
139	ELLIS	19			1										139
141	EL PASO	57													141
143	ERATH	19													143
145	FALLS	19			1										145
147	FANNIN	19			1										147
149	FAYETTE	19	2		1									X	149
151	FISHER	19													151
153	FLOYD	59													153
155	FOARD														155
157	FORT BEND														157
159	FRANKLIN		2												159
161	FREESTONE	19	2		1										161
163	FRIO				1										163
165	GAINES	59													165
167	GALVESTON	4 24													167
169	GARZA	59													169
171	GILLESPIE	19 67													171
173	GLASSCOCK														173
175	GOLIAD													X	175
177	GONZALES	19 67			1									X	177
179	GRAY	59													179
181	GRAYSON	19													181
183	GREGG		2												183
185	GRIMES		2											X	185
187	GUADALUPE	67			1										187
189	HALE	59													189
191	HALL	59													191
193	HAMILTON	19													193
195	HANSFORD	19 59													195
197	HARDEMAN	19 59													197
199	HARDIN														199

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=48 STATE=TEXAS --

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CO
201	HARRIS	4												X	201
203	HARRISON		2												203
205	HARTLEY	59													205
207	HASKELL														207
209	HAYS	19 67			1										209
211	HEMPHILL	19 59													211
213	HENDERSON		2		1										213
215	HIDALGO	21													215
217	HILL	19			1										217
219	HOCKLEY	59													219
221	HOOD	19													221
223	HOPKINS				1										223
225	HOUSTON		2												225
227	HOWARD														227
229	HUDSPETH	57													229
231	HUNT				1										231
233	HUTCHINSON	59													233
235	IRION														235
237	JACK														237
239	JACKSON	4												X	239
241	JASPER														241
243	JEFF DAVIS	57 67													243
245	JEFFERSON	4 24 49													245
247	JIM HOGG													X	247
249	JIM WELLS													X	249
251	JOHNSON	19													251
253	JONES	19													253
255	KARNES	67			1			X						X	255
257	KAUFMAN				1										257
259	KENDALL	19 67													259
261	KENEDY	24													261
263	KENT	59													263
265	KERR	19 67													265
267	KIMBLE	19 67													267
269	KING	59													269
271	KINNEY	67			1										271
273	KLEBERG	4 24													273
275	KNOX														275
277	LAMAR	19													277
279	LAMB	59													279
281	LAMPASAS	19 67													281
283	LA SALLE														283
285	LAVACA													X	285
287	LEE	19	2		1										287
289	LEON	19	2		1										289
291	LIBERTY	4												X	291
293	LIMESTONE	19			1										293
295	LIPSCOMB	19 59													295
297	LIVE OAK							X						X	297
299	LLANO	19 67													299
301	LOVING	57													301
303	LUBBOCK	59													303
305	LYNN	59													305
307	MCCULLOCH	19 67													307
309	MCLENNAN	19			1										309
311	MCMULLEN													X	311
313	MADISON	19	2												313
315	MARION		2				X								315
317	MARTIN														317
319	MASON	19 67													319
321	MATAGORDA	4 24													321
323	MAVERICK				1										323
325	MEDINA	67			1										325
327	MENARD	19 60 67													327
329	MIDLAND														329
331	MILAM	19	2		1										331
333	MILLS	19													333
335	MITCHELL														335
337	MONTAGUE	19													337
339	MONTGOMERY													X	339
341	MOORE	59													341
343	MORRIS		2												343
345	MOTLEY	59													345
347	NACOGDOCHES		2												347
349	NAVARRO	19			1										349

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=48 STATE=TEXAS --

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
351	NEWTON	49													351
353	NOLAN	19													353
355	NUECES	4 24												X	355
357	OCHILTREE	19 59													357
359	OLDHAM	59													359
361	ORANGE	49													361
363	PALO PINTO	19													363
365	PANOLA		2												365
367	PARKER	19													367
369	PARMER	59													369
371	PECOS	57 60 67													371
373	POLK														373
375	POTTER	59													375
377	PRESIDIO	57 67											X		377
379	RAINS		2												379
381	RANDALL	59													381
383	REAGAN	67													383
385	REAL	19 67													385
387	RED RIVER	19													387
389	REEVES	57 60 67													389
391	REFUGIO	4												X	391
393	ROBERTS	59													393
395	ROBERTSON	19	2		1										395
397	ROCKWALL				1										397
399	RUNNELS	19													399
401	RUSK		2												401
403	SABINE	49													403
405	SAN AUGUSTINE														405
407	SAN JACINTO													X	407
409	SAN PATRICIO	4												X	409
411	SAN SABA	19 67													411
413	SCHLEICHER	19 67													413
415	SCURRY	59													415
417	SHACKELFORD	19													417
419	SHELBY		2												419
421	SHERMAN	19 59													421
423	SMITH						X								423
425	SOMERVELL	19													425
427	STARR	21												X	427
429	STEPHENS	19													429
431	STERLING														431
433	STONEWALL														433
435	SUTTON	19 67													435
437	SWISHER	59													437
439	TARRANT														439
441	TAYLOR	19													441
443	TERRELL	57 67													443
445	TERRY	59													445
447	THROCKMORTON														447
449	TITUS		2												449
451	TOM GREEN	19													451
453	TRAVIS	19 67			1										453
455	TRINITY		2												455
457	TYLER														457
459	UPSHUR														459
461	UPTON	57 67													461
463	UVALDE	67			1					2					463
465	VAL VERDE	57 67													465
467	VAN ZANDT		2												467
469	VICTORIA	4												X	469
471	WALKER		2											X	471
473	WALLER													X	473
475	WARD	57 67													475
477	WASHINGTON	19	2		1									X	477
479	WEBB													X	479
481	WHARTON													X	481
483	WHEELER	19 59													483
485	WICHITA	19													485
487	WILBARGER	19													487
489	WILLACY	4 21 24													489
491	WILLIAMSON	19 67			1										491

FIPS STATE NUMBER=48 STATE=TEXAS

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
493	WILSON	67			1										493
495	WINKLER														495
497	WISE														497
499	WOOD		2												499
501	YOAKUM	59													501
503	YOUNG														503
505	ZAPATA	21												X	505
507	ZAVALA				1										507

FIPS STATE NUMBER=49 STATE=UTAH

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	BEAVER			X	1	X		X					X	X	001
003	BOX ELDER	25		X	3								X		003
005	CACHE	25			3										005
007	CARBON	13 25	2							3					007
009	DAGGETT	13 25								1					009
011	DAVIS	25													011
013	DUCHESNE	13 25			3					3					013
015	EMERY	13 25	2							1				X	015
017	GARFIELD	13 25	1							2				X	017
019	GRAND	13 25								3				X	019
021	IRON	13	1		2	X	X						X	X	021
023	JUAB	25		X	2	X							X	X	023
025	KANE	13 25	3											X	025
027	MILLARD	25			3										027
029	MORGAN	25													029
031	PIUTE	13 25				X							X	X	031
033	RICH	25										X			033
035	SALT LAKE	25		X	3	X		X					X		035
037	SAN JUAN	13 25		X						2				X	037
039	SANPETE	13 25			3										039
041	SEVIER	13 25	2		1									X	041
043	SUMMIT	13 25								1					043
045	TOOELE	25		X	3	X							X		045
047	UINTAH	13 25	2	X	3					3		X	X		047
049	UTAH	13 25		X		X				1			X		049
051	WASATCH	13 25		X		X				1			X		051
053	WASHINGTON	13		X	2		X						X		053
055	WAYNE	13 25	2							2				X	055
057	WEBER	25			3										057

FIPS STATE NUMBER=50 STATE=VERMONT

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADDISON	36 76													001
003	BENNINGTON	22 36 76													003
005	CALEDONIA	26 36 76													005
007	CHITTENDEN	36 76													007
009	ESSEX	26 36 76													009
011	FRANKLIN	36 76													011
013	GRAND ISLE	36 76													013
015	LAMOILLE	36 76													015
017	ORANGE	26 36 76		X									X		017
019	ORLEANS	36 76													019
021	RUTLAND	22 26 36						X							021

APPENDIX C (CONTINUED)

FIPS STATE NUMBER=50 STATE=VERMONT

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		76													
023	WASHINGTON	36													C23
		76													
025	WINDHAM	22													C25
		26													
		36													
		76													
027	WINDSOR	26													C27
		36													
		76													

FIPS STATE NUMBER=51 STATE=VIRGINIA

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ACCOMACK	14													C01
		24													
		27													
		51													
003	ALBEMARLE	51													C03
005	ALLEGHANY	14													C05
		51													
007	AMELIA	14													C07
		51													
009	AMHERST	14					X								C09
		51													
011	APPOMATTOX	51					X								C11
013	ARLINGTON	14													C13
		19													
		51													
		76													
015	AUGUSTA	14													C15
		51													
017	BATH	51													C17
019	BEDFORD	51					X								C19
021	BLAND														C21
023	BOTETOURT	14													C23
		51													
025	BRUNSWICK	51													C25
027	BUCHANAN		3												C27
029	BUCKINGHAM	14		X											C29
		51													
031	CAMPBELL	51													C31
033	CAROLINE	14													C33
		19													
		51													
035	CARROLL			X			X						X		C35
036	CHARLES CITY	14													C36
		19													
		27													
		51													
037	CHARLOTTE	51													C37
041	CHESTERFIELD	14													C41
		51													
043	CLARKE	14													C43
		51													
		76													
045	CRAIG	51													C45
047	CULPEPER	51													C47
		76													
049	CUMBERLAND	14													C49
		51													
051	DICKENSON	65	2												C51
053	DINWIDDIE	51													C53
057	ESSEX	14													C57
		19													
		27													
		51													
059	FAIRFAX	14													C59
		19													
		51													
		76													
061	FAUQUIER	51				X									C61
		76													
063	FLOYD			X											C63
065	FLUVANNA	51				X									C65
067	FRANKLIN	51													C67
069	FREDERICK	51													C69
		76													
071	GILES														C71
073	GLOUCESTER	14													C73
		19													
		27													
		51													
075	GOOCHLAND	51				X									C75
077	GRAYSON			X			X								C77
079	GREENE	51													C79
081	GREENSVILLE	51													C81
083	HALIFAX	51		X									X		C83
085	HANOVER	19													C85
		51													

APPENDIX C (CONTINUED)

--- FIPS STATE NUMBER=51 STATE=VIRGINIA ---

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
087	HENRICO	51													087
089	HENRY														089
091	HIGHLAND	51													091
093	ISLE OF WIGHT	14													093
		19													
		27													
		51													
095	JAMES CITY	14													095
		19													
		27													
		51													
097	KING AND QUEEN	14													097
		19													
		51													
099	KING GEORGE	14													099
		19													
		27													
		51													
101	KING WILLIAM	14													101
		19													
		51													
103	LANCASTER	14													103
		19													
		27													
		51													
105	LEE	65	2				X								105
107	LOUDOUN	14													107
		51													
		76													
109	LOUISA	51		X		X							X		109
111	LUNENBURG	51													111
113	MADISON	51													113
115	MATHEWS	14													115
		19													
		27													
		51													
117	MECKLENBURG	51													117
119	MIDDLESEX	14													119
		19													
		27													
		51													
121	MONTGOMERY		2												121
125	NELSON	14													125
		51													
127	NEW KENT	14													127
		19													
		27													
		51													
131	NORTHAMPTON	14													131
		24													
		27													
		51													
133	NORTHUMBERLAND	14													133
		19													
		27													
		51													
135	NOTTOWAY	51													135
137	ORANGE	51				X									137
139	PAGE	51													139
		76													
141	PATRICK			X											141
143	PITTSYLVANIA	51													143
145	POWHATAN	51													145
147	PRINCE EDWARD	51													147
149	PRINCE GEORGE	14													149
		19													
		27													
		51													
153	PRINCE WILLIAM	14		X											153
		51													
		76													
155	PULASKI		2				X								155
157	RAPPAHANNOCK	51													157
		76													
159	RICHMOND	14													159
		19													
		27													
		51													
161	ROANOKE	51													161
163	ROCKBRIDGE	14					X								163
		51													
165	ROCKINGHAM	51													165
		76													
167	RUSSELL	65	2												167
169	SCOTT	65	2												169
171	SHENANDOAH	51													171
		76													
173	SMYTH						X								173
175	SOUTHAMPTON	51													175
177	SPOTSYLVANIA	14		X		X							X		177
		51													
179	STAFFORD	14													179

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=51 STATE=VIRGINIA --

FIPS_CC	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
		51													
181	SURRY	14 19 27 51													181
183	SUSSEX	51													183
185	TAZEWELL		2												185
187	WARREN	51 76													187
191	WASHINGTON														191
193	WESTMORELAND	14 19 27 51													193
195	WISE	65	2				X								195
197	WYTHE						X						X		197
199	YORK	14 19 27 51													199
550	NORFOLK/CHESAPEAKE	14 19 27 51													550
650	HAMPTON	14 19 27 51													650
700	NEWPORT NEWS	14 19 27 51													700
800	SUFFOLK/NANSEMOND	14 19 27 51													800
810	VIRGINIA BEACH	14 19 24 27 51													810

-- FIPS STATE NUMBER=53 STATE=WASHINGTON --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ADAMS	1													001
003	ASOTIN	1													003
005	BENTON	1													005
007	CHELAN	1 39		X		X	X	X	X				X		007
009	CLALLAM	31 39			3										009
011	CLARK														011
013	COLUMBIA	1													013
015	COWLITZ														015
017	DOUGLAS	1													017
019	FERRY			X		X		X	X				X		019
021	FRANKLIN	1													021
023	GARFIELD	1													023
025	GRANT	1						X							025
027	GRAYS HARBOR	31													027
029	ISLAND	31 39													029
031	JEFFERSON	31 39													031
033	KING	31 39	2			X	X	X							033
035	KITSAP	31 39													035
037	KITTITAS	1 39	2			X	X	X	X						037
039	KLICKITAT	1													039
041	LEWIS	39	3		2			X							041
043	LINCOLN							X							043
045	MASON	31 39													045
047	OKANOGAN	1 39		X		X	X	X					X		047
049	PACIFIC	31													049
051	PEND OREILLE						X	X					X	X	051
053	PIERCE	31 39	2												053
055	SAN JUAN	31 39													055
057	SKAGIT	31 39					X	X							057
059	SKAMANIA	1		X				X							059
061	SNOHOMISH	31 39		X	1	X		X	X				X		061
063	SPOKANE													X	063

APPENDIX C (CONTINUED)

FIPS STATE NUMBER=53 STATE=WASHINGTON

FIPS_CC	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
065	STEVENS			X		X	X	X					X	X	C65
067	THURSTON	31 39	2												C67
069	WAHKIAKUM														C69
071	WALLA WALLA	1			3										C71
073	WHATCOM	31 39	2		2	X	X	X							C73
075	WHITMAN	1													C75
077	YAKIMA	1 39			3			X							C77

FIPS STATE NUMBER=54 STATE=WEST VIRGINIA

FIPS_CO	COUNTY	IRP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	BARBOUR	76	3		1										C01
003	BERKELEY	14 51 76								1					C03
005	BOONE		3												C05
007	BRAXTON	76	2		1		X								C07
009	BROOKE	77	2												C09
011	CABELL	77	2												C11
013	CALHOUN		1												C13
015	CLAY		2												C15
017	DODDRIDGE		2												C17
019	FAYETTE		3		1										C19
021	GILMER		2												C21
023	GRANT	51 76	2				X			1					C23
025	GREENBRIER		2		1		X			1					C25
027	HAMPSHIRE	51 76								1					C27
029	HANCOCK	77	2												C29
031	HARDY	51 76								1					C31
033	HARRISON	76	2		1										C33
035	JACKSON	77													C35
037	JEFFERSON	14 51 76													C37
039	KANAWHA		3												039
041	LEWIS	76	2		1		X								C41
043	LINCOLN		2												C43
045	LOGAN		3												C45
047	MCDOWELL		3												C47
049	MARION	76	3		1										C49
051	MARSHALL	77	3												C51
053	MASON	77	2												C53
055	MERCER		2							1					C55
057	MINERAL	51 76	2							1					C57
059	MINGO		3												C59
061	MONONGALIA	76	3		1										061
063	MONROE									1					C63
065	MORGAN	51 76								1					C65
067	NICHOLAS		3		1										C67
069	OHIO	77	2												C69
071	PENDLETON	51 76								1					C71
073	PLEASANTS	77													C73
075	POCAHONTAS	51 76	2		1		X			1					C75
077	PRESTON	76	2		1										C77
079	PUTNAM		2												C79
081	RALEIGH		3												C81
083	RANDOLPH	51 76	2		1					1					C83
085	RITCHIE														C85
087	ROANE		2												C87
C89	SUMMERS		1												C89
091	TAYLOR	76	2		1		X								C91
093	TUCKER	51 76	2		1										C93
095	TYLER	77	2												C95
097	UPSHUR	76	2		1										C97
099	WAYNE	77	2												C99
101	WEBSTER	76	3		1										101
103	WETZEL	76 77	2												103
105	WIRT														105
107	WOOD	77													107
109	WYOMING		3												109

APPENDIX C (CONTINUED)

```
--------------------------------------------- FIPS STATE NUMBER=55   STATE=WISCONSIN ---------------------------------------------

FIPS_CO   COUNTY            IRP  COAL  CU  G_T  AU  FE  CO  NI  O_S  PEAT  P  AG  U  FIPS_CC

001       ADAMS             11                                         1              C01
                            34
                            71
                            77
003       ASHLAND           11                      X                  2              003
                            73
005       BARRON            34                                                        C05
                            71
                            77
007       BAYFIELD          11                                         2              C07
                            73
009       BROWN             11                                         2              C09
                            73
011       BUFFALO           27                                                        C11
                            66
                            72
                            77
013       BURNETT           34                                                        C13
                            71
                            77
015       CALUMET           11                                         2              C15
                            34
                            71
                            77
017       CHIPPEWA          34                                                        C17
                            71
                            77
019       CLARK             34                                                        C19
                            71
                            77
021       COLUMBIA          11                                         2              C21
                            34
                            71
                            77
023       CRAWFORD          27                                                        C23
                            66
                            72
                            77
025       DANE              34                                                        C25
                            71
                            77
027       DODGE             34                      X                  2              C27
                            71
                            77
029       DOOR              11                                                        C29
                            73
031       DOUGLAS           11                                                        031
                            34
                            73
                            77
033       DUNN              34                                                        C33
                            71
                            77
035       EAU CLAIRE        34                                                        C35
                            71
                            77
037       FLORENCE          11                      X                                 C37
039       FOND DU LAC       11                                         2              C39
                            34
                            71
                            77
041       FOREST            11         X        X                      2       X      C41
043       GRANT             27                                                        C43
                            66
                            72
                            77
045       GREEN             71                                                        C45
                            77
047       GREEN LAKE        11                                         2              C47
                            34
                            71
                            77
049       IOWA              77                                                        C49
051       IRON              11                      X                  2              C51
                            73
053       JACKSON           71                      X                  1              C53
                            77
055       JEFFERSON         34                                         2              C55
                            71
                            77
057       JUNEAU            34                                         1              C57
                            71
                            77
059       KENOSHA           11                                                        C59
                            34
                            73
                            77
061       KEWAUNEE          11                                                        C61
                            73
063       LA CROSSE         27                                                        C63
                            66
                            72
```

APPENDIX C (CONTINUED)

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--------------------------------------------- FIPS STATE NUMBER=55   STATE=WISCONSIN --------------------------------------------------

FIPS_CO   COUNTY                IMP   COAL   CU    G_T   AU    FE    MO    NI    O_S    PEAT   P    AG   U    FIPS_CC

                                77
065       LAFAYETTE             77                                                                            065
067       LANGLADE              11                                                      2                     067
069       LINCOLN               77                                                      2                     069
071       MANITOWOC             11                                                                            071
                                34
                                71
                                73
                                77
073       MARATHON              11                                                                            073
                                34
                                71
                                77
075       MARINETTE             11                                   X                                        075
                                73
077       MARQUETTE             11                                                      1                     077
                                34
                                71
                                77
078       MENOMINEE             11                                                      2                     078
079       MILWAUKEE             11                                                                            079
                                34
                                73
                                77
081       MONROE                77                                                      2                     081
083       OCONTO                11                                                      2                     083
                                73
085       ONEIDA                11           X           X                              2           X         085
087       OUTAGAMIE             11                                                      2                     087
                                34
                                77
089       OZAUKEE               11                                                                            089
                                34
                                73
                                77
091       PEPIN                 66                                                                            091
                                72
                                77
093       PIERCE                66                                                                            093
                                72
                                77
095       POLK                  34                                                                            095
                                71
                                77
097       PORTAGE               11                                                      1                     097
                                34
                                71
                                77
099       PRICE                 77                                                      2                     099
101       RACINE                11                                                                            101
                                34
                                73
                                77
103       RICHLAND              77                                                                            103
105       ROCK                  71                                                                            105
                                77
107       RUSK                  34           X                                          2           X         107
                                71
                                77
109       ST CROIX              34                                                                            109
                                66
                                72
                                77
111       SAUK                  71                             X                        1                     111
                                77
113       SAWYER                34                                                      2                     113
                                71
                                77
115       SHAWANO               11                                                      2                     115
117       SHEBOYGAN             11                                                                            117
                                34
                                71
                                73
                                77
119       TAYLOR                34                                                      2                     119
                                71
                                77
121       TREMPEALEAU           27                                                                            121
                                66
                                72
                                77
123       VERNON                27                                                                            123
                                66
                                72
                                77
125       VILAS                 11                                                      2                     125
127       WALWORTH              34                                                                            127
                                71
                                77
129       WASHBURN              34                                                                            129
                                71
                                77
```

APPENDIX C (CONTINUED)

-- FIPS STATE NUMBER=55 STATE=WISCONSIN --

FIPS_CC	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
131	WASHINGTON	11 34 71 77									2				131
133	WAUKESHA	11 34 71 77													133
135	WAUPACA	11 34 77									2				135
137	WAUSHARA	11 34 71 77									1				137
139	WINNEBAGO	11 34 71 77									2				139
141	WOOD	34 71 77									1				141

-- FIPS STATE NUMBER=56 STATE=WYOMING --

FIPS_CO	COUNTY	IMP	COAL	CU	G_T	AU	FE	MO	NI	O_S	PEAT	P	AG	U	FIPS_CC
001	ALBANY	25	2	X		X	X							X	C01
003	BIG HORN	25 63	1											X	C03
005	CAMPBELL	25 63	3											X	C05
007	CARBON	13 25	3	X			X			1				X	C07
009	CONVERSE	25 63	3		3									X	C09
011	CROOK	6 25 63	1											X	C11
013	FREMONT	13 25 63	2		3	X	X							X	C13
015	GOSHEN	12 25												X	C15
017	HOT SPRINGS	25 63	2		3										C17
019	JOHNSON	25 63	3											X	C19
021	LARAMIE	25													C21
023	LINCOLN	13 25	3		2					1		X		X	C23
025	NATRONA	25 63	2											X	C25
027	NIOBRARA	6 25													C27
029	PARK	25 63	2	X		X		X							C29
031	PLATTE	25		X			X							X	C31
033	SHERIDAN	25 63	3												C33
035	SUBLETTE	13 25 63								1					C35
037	SWEETWATER	13 25	3							1				X	C37
039	TETON	25 63			1										C39
041	UINTA	13 25	2							1					C41
043	WASHAKIE	25 63	2												C43
045	WESTON	6 25	2											X	C45

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ATLAS OF COAL/MINERALS AND IMPORTANT RESOURCE PROBLEM AREAS FOR FISH AND WILDLIFE IN THE CONTERMINOUS UNITED STATES

5. Report Date
July 1981

6.

7. Author(s) Robert A. Honig (FWS), Richard J. Olson (Oak Ridge Lab) and William T. Mason, Jr. (FWS)

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9. Performing Organization Name and Address cooperative performance between:

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Office of Biological Services	Environmental Sciences Division
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14.

15. Supplementary Notes
1:7,500,000-scale maps NOT included with this publication
Text material in this publication ONLY available through NTIS

16. Abstract (Limit: 200 words)

The atlas highlights areas in the conterminous US of potential concern involving coal and minerals development activities and fish and wildlife resources, in particular the Important Resource Problem Areas (IRPs) designated in 1980 by the US Fish and Wildlife Service as areas of emphasis in policymaking. The atlas serves as an initial screening tool for national and regional planners and administrators to help define areas that may require additional analysis prior to development in order to minimize disturbances and adverse impacts on fish and wildlife resources and to protect and enhance these resources where practicable.

The publication contains maps of selected mineral resources (coal, copper, geothermal resources, gold, iron, molybdenum, nickel, oil shale/tar sands, peat, phosphate, silver, uranium), IRPs, and Federal Endangered and Threatened Animal Species. An overlay of the IRP map is provided: by placing this on a mineral map, counties containing both mineral and wildlife resources will be highlighted. Background information on IRPs, the mineral commodities, and environmental impacts of mineral mining is provided, as well as appendices which tabulate the data displayed in the maps. The document can also be used with a series of 1:7,500,000-scale reproductions of the maps.

17. Document Analysis a. Descriptors coal, copper, geothermal, gold, iron, molybdenum, nickel, oil shale, tar sands, peat, phosphate, silver, uranium, endangered species, threatened species, Important Resource Problems, U.S. Fish and Wildlife Service

b. Identifiers/Open-Ended Terms mineral deposits, mineral resources, mining, environmental impacts, fish resources, wildlife resources, national planning, regional planning, natural resources

c. COSATI Field/Group 48B, 48A, 57H

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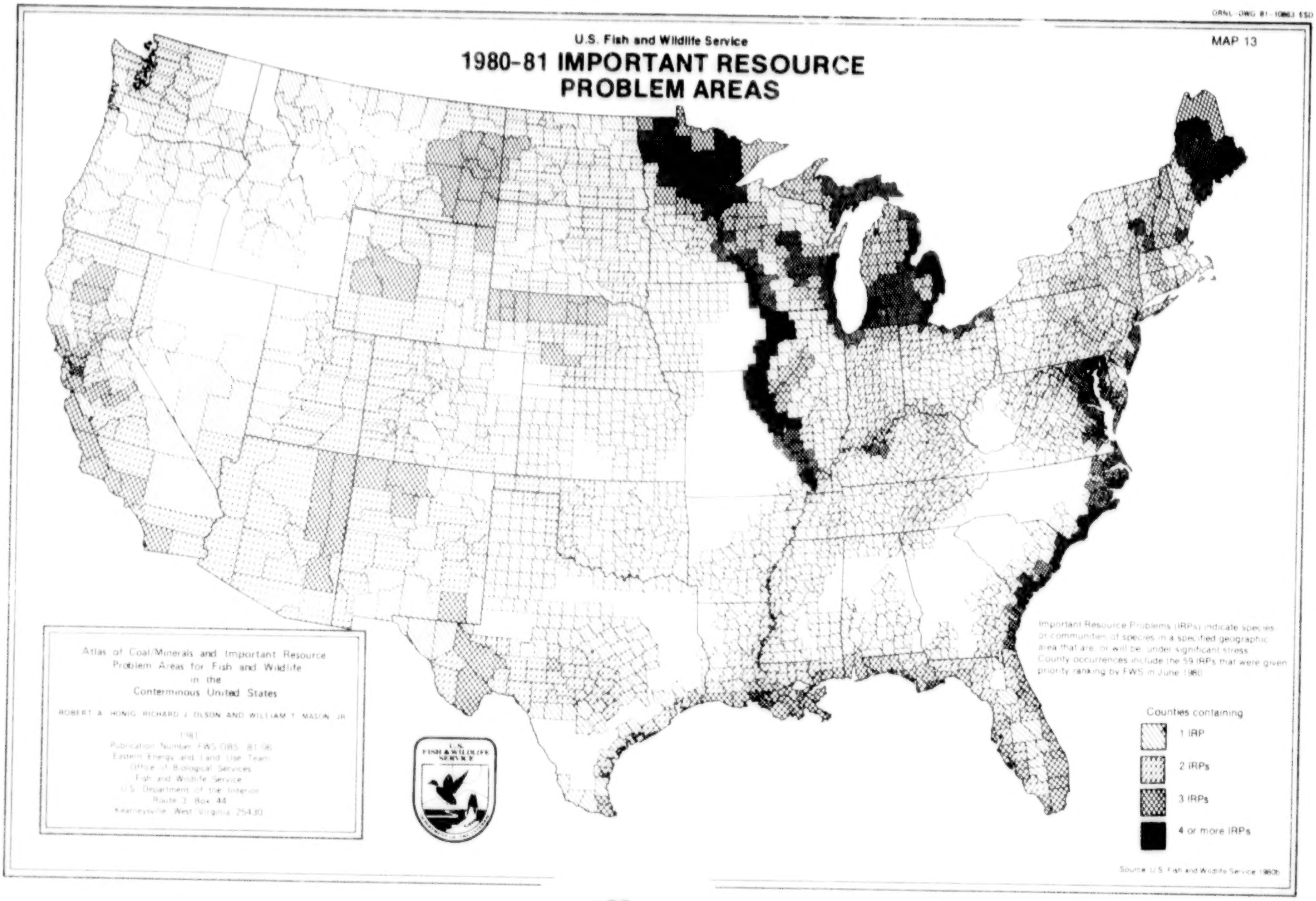

1980-81 IMPORTANT RESOURCE PROBLEM AREAS

Important Resource Problems (IRPs) indicate species or communities of species in a specified geographic area that are, or will be, under significant stress. County occurrences include the 59 IRPs that were given priority ranking by FWS in June 1980.

Counties containing

- ▨ 1 IRP
- ▤ 2 IRPs
- ▩ 3 IRPs
- ■ 4 or more IRPs

Source: U.S. Fish and Wildlife Service 1980b

Atlas of Coal/Minerals and Important Resource
Problem Areas for Fish and Wildlife
in the
Conterminous United States

ROBERT A. HONIG, RICHARD J. OLSON AND WILLIAM T. MASON, JR.

1981
Publication Number FWS/OBS-81/06
Eastern Energy and Land Use Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior
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